A Comparison of Elderly CABG and OPCAB Patients' Recovery Experiences

By

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ABSTRACT

TITLE: A Comparison of Elderly CABG, OPCAB, and MIDCAB Patients' Recovery Experiences

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Acute care nurses care for a variety of open heart surgery (OHS) patients who are elderly (65 years or older). While research on the coronary artery bypass graft (CABG) patient population is prolific, there is a lack of previous research in understanding the off-pump coronary artery bypass graft (OPCAB) patients. This retrospective study described the recovery of elderly CABG and OPCAB patients throughout their hospitalizations. Preoperative, intraoperative, cardiac intensive care unit (CICU), and ward time periods were examined. Within these time periods, the more than 200 variables were categorized as demographic, physiological, time and functional, and provider therapy.

The 65 subjects (mean age of 75.3 years, SE .5), had a CABG or OPCAB procedure. CABG and OPCAB subjects were matched by age and gender. For description and comparison, the sample was divided into surgery groups (CABG n=33; OPCAB n=32), age groups (young-old: age 67-74, n=32; old (age 75-86, n=33), and gender groups (male, n=33; female (n=32). Within each of the three groups, subgroups similar preoperatively based on number of comorbidities.

Data were analyzed using descriptive statistics and t-tests, chi square and Fisher's exact. Statistical significance was set at $p = .01$ or less due to multiple comparisons. Clinical significance was set at $p > .01$ - .065.

Results highlights include: a) CABG patients received more grafts (p= .001), b) had lower Glascow Coma Scores on admission to CICU (p= .001), c) had more blood output (p= .018), and d) stayed longer in the hospital (p= .052) than their OPCAB counterparts. The old subjects received less crystalloid during the intraoperative period (p= .005) and while their Cardiac RiskMaster scores were higher than for the young-old (p= .004), the two age groups did not vary based on transfusions received (p= .683). Invasive lines in CICU stayed in a clinically significantly longer period for the old. Males received more beta-blockers during the preoperative time period (p= .033), while females received more diuretics (p= .029), hormone replacement therapy (p= .000), inotropes (p= .034), and thryoid replacement (p= .005). While females had higher preoperative Cardiac RiskMaster scores in the near-miss (p= .040), transfusion (p= .003), and stroke (p= .033) categories, they did not have higher incidence of these untoward outcomes than their male counterparts. Males received more morphine equivalencies for pain relief on postoperative day two (p= .007), which is consistent with other research. There were 11 case (17%) of postoperative delirium. While this finding did not reach defined statistical or clinical significance levels, it did occur in both surgery groups (7 CABG and 4 OPCAB), more in the old than the young-old and more in the women than men.

This is the first study to examine multiple recovery variables throughout the course of hospitalization for elderly CABG and OPCAB patients. It provides descriptive and comparative data that will enable nurses to anticipate and respond to elders of various ages recovering from CABG and OPCAB surgeries.

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CHAPTER 1: INTRODUCTION

Coronary heart disease (CHD) remains a significant health problem in the United States. Unstable coronary syndromes with its various manifestations (primarily myocardial ischemia) are the major clinical problems of this disease. Though the levels of mortality associated with these condition have decreased, myocardial infarction (MI) remains the number one killer in this country. Every year approximately 1.5 million Americans have a MI and about 1/3 of those die as a result.

Myocardial ischemia and/or infarction occur because of an imbalance between coronary artery blood supply and myocardial oxygen demand. The primary causes of a decreased coronary artery blood flow are atherosclerosis, thrombus formation and/or vasospasm. Unless coronary blood flow is restored quickly, myocardial ischemia and myocardial cell death are the result (Osguthorpe & Woods, 1995).

There are several medical treatment options for patients with compromised coronary artery blood flow. The medical treatment options include medication management, angioplasty, rotoblade or stent placement in the affected coronary artery(ies). The history of coronary artery bypass surgery began in 1910 when physician Alexis Carrel attempted to use a carotid artery to create an anastomosis between the descending aorta and left coronary artery of a dog. The dog died after suffering ventricular fibrillation. In 1962 Dr. Sabiston of Duke University used this technique on a patient using a saphenous vein. The patient died two days later presumably because the thrombus that had formed on the vein graft broke free and traveled to his brain, resulting in a cerebrovascular accident (CVA) (Reardon, Conklin, Reardon & Baldwin, 1997). Current surgical treatment options for coronary artery narrowing or blockage include traditional coronary artery bypass grafting, or on-pump CABG; off-pump coronary artery

bypass (OPCAB) grafting; or a minimally invasive direct coronary artery bypass graft (MIDCAB) procedure.

With the disproportionate aging of America, the likelihood of increasing numbers of elders requiring coronary revascularization procedures is great. The need for nursing to understand what constitutes the best care for these elders is equally great. Acute care nurses play a pivotal role in the care of patients with revascularization procedures, namely the CABG, OPCAB and MIDCAB patient populations. While care of the CABG population was been well researched over the last several decades, the OPCAB and MIDCAB procedures are relatively new and largely unexplored within nursing's scientific literature. While the procedures all accomplish a similar end-result, better understanding the recovery trajectory of OPCAB and MIDCAB patients is fundamental to providing the most appropriate care during hospitalization.

This study described and compared the groups of patients who were 65 or older at the time of their CABG or OPCAB surgery. These patients received hospital care at a large tertiary care medical center in the Northwestern United States.

Subjects in the samples were grouped based on age and gender. Comparisons of the two groups' preexisting co-morbid conditions and post-operative course were made. The specific aims for this study are:

1. How does recovery of elderly CABG and OPCAB patients compare during the hospital stay?

2. What recovery variation is present between the young-old and old age groups?

3. What recovery variation is present between the elderly male and female patients?

CHAPTER 2: REVIEW OF THE LITERATURE

Historical Review of CABG, OPCAB's & MIDCAB's as Surgical Intervention for Coronary Stenosis

Atherosclerosis is a form of arteriosclerosis and is characterized by fibro-fatty lesions formation on the intimal layer of the medium and large size arteries of the body. The coronary arteries are the most commonly affected vessels and depending on the degree of arterial narrowing, surgical vascularization is sometimes required (Porth, 1998). The coronary artery bypass grafting (CABG) procedure has been the primary surgical means of restoring adequate blood supply to the heart muscle for some thirty years.

In 1964, Dr. Sabiston of Duke University performed the first successful CABG in the United States (U.S.) using a saphenous vein. The saphenous vein remained the bypass vessel of choice for some 20 years. Advantages of using this vessel included ease of harvest, large vessel diameter, ample supply and excellent flow rates.

Gradually, several disadvantages of using the saphenous vein became apparent. Patency of the vessel over time deteriorated with a one month occlusion rate of 10% and another 2-4% per year during the first five years and 4-8% after the fifth year. These difficulties prompted surgeons to use different surgical techniques such as sequential bypassing and finally to seek other vessels with better patency properties, such as the internal mammary artery (IMA). Additional arteries used for bypass included the right gastroepiploic artery (RGEA), the radial artery (RA) and the inferior epigastric artery (Reardon, Conklin, Reardon & Baldwin, 1997).

The traditional CABG procedure involves the performance of a median sternotomy, spreading the patient's ribs open horizontally, using cardioplegic solution to stop the heart and maximize the protection of the myocardium and cannulating large

vessels to place the patient on cardiopulmonary bypass (CPB) for the operative period (Zeidman, 1998). CPB provides essential oxygenated blood flow to the patient and allows a surgeon to artificially arrest the heart and work in a relatively bloodless field (Benetti and Akin, 1998). Opening the chest and inserting the cannulas required to perform CPB is not without risk however. Morbidity and mortality are increased based on the risk of infection, stroke from the showering of micro emboli, activation of the neutrophils and complement factors which can produce a total body inflammatory response, damage to the blood components, renal insufficiency or failure and post-pump syndrome. Post-pump syndrome is characterized by disruption of thought processes, confusion and/or delirium. This confusion can be temporary or permanent. Additional morbidity risks include OR-induced hypothermia, peri- or post-operative myocardial infarction (MI), hemodynamic instability, peri- and post-operative bleeding, and electrolyte disturbances.

Intensive care nurse clinicians and researchers, along with their medical colleagues, have investigated the CABG population since the late 1960's. Primary areas of research germane to this study include the influence of pre-operative characteristics on CABG outcomes; the influence of comorbid conditions on CABG outcomes; the influence of pre- and post-surgery education and rehabilitation on CABG outcomes; the trajectory of expected and unexpected operative, intensive care, and post-intensive care hospital outcomes; and quality of life.

While the survival rates for those having CABG with CPB have improved over time, the morbidity and mortality associated with the surgery has spawned several new medical treatments. In 1977, Gruentzig introduced the first angioplasty catheter. Angiotherapy has been considered highly efficacious for single vessel or multi vessel coronary disease that is relatively easy to access in a cardiovascular lab setting. Catheter-

based technologies have improved over time with their use increasing over the past two decades to include the placement of cardiac stents and the use of rotoblades to shear away atherosclerotic plaque(s). It is now suggested that these catheter-based therapies be used in combination with cardiac surgery to better meet the revascularization needs of the cardiac surgery patients. MIDCAB patients in the proposed study have angiograms when moving from the operating room to the intensive care setting to assure graft patency.

Over the last several years several promising surgical procedures have emerged for select groups of bypass patients. The first is the rediscovery of Off-Pump Coronary Artery Bypass (OPCAB). Originally this technique was pioneered in the late 1960's, but the technique was abandoned with the advent of cardiopulmonary bypass and cardioplegic arrest of the heart. With the increasing emphasis on minimally invasive surgery, optimizing patient outcomes, and containing costs, this procedure is enjoying a resurgence of popularity in some heart centers (Puskas, et al, 1998). This procedure can be performed using the same surgical approach as the CABG, but use of the cardiopulmonary bypass (CPB) machine is avoided by minimizing oxygen demand and operating on a heart whose rate has been slowed to a level that maintains circulation and perfusion. CPB produces complications; avoiding the use of this device can help minimize the incidence of renal failure, bleeding complications, an acute systemic inflammatory response, neurological sequelae, post-pump syndrome and/or adult respiratory distress syndrome.

The second promising surgical procedure for coronary artery revascularization is the Minimally Invasive Direct Coronary Artery Bypass or NMCAB. During 1995, Subramanian reported results from a multi-site study with over 150 subjects who had this revolutionary new surgery. MIDCAB is defined as bypass graft surgery performed through small incisions between the ribs without the assistance of CPB (Vitello-Cicciu,

Fitzgerald, & Whalen, 1998). The MIDCAB procedure is performed through a 8-12 cm thoracotomy incision and does not require cardiac arrest or hypothermia. This surgical approach is also known as a Limited Anterior Small Thoracotomy (LAST). Bypass anastomoses are done on a beating heart through a small lateral incision between the third and fourth ribs on the left side of the anterior chest. Further argument in support of the MIDCAB procedure is that it is safe, grafts have excellent patency and minimally invasive approach has less effect on hemostasis, fewer blood transfusions are required and lengths of stay in the hospital are shorter (Douville, et al, 1999; Douville, 1997).

The MIDCAB procedure is ideal for patients who require a single bypass to the Left Anterior Descending (LAD) artery and have equal or greater risk scores than their traditional CABG counterparts. The Left Internal Mammary Artery (LIMA) and the inferior epigastric artery are often chosen as the bypass vessels. Using these arteries instead of traditional choice of saphenous leg veins offers considerable advantage in terms of the expected longer-term patency of 10 vs. 15 or more years.

Influence of Pre-Operative Characteristics on CABG Outcomes

Several research groups have sought to determine the significant pre-operative risk factors for morbidity and mortality during or after a CABG. Variables that correlated with higher rates or morbidity and mortality in one large study included: 1) increased age, 2) angina, 3) increased American Society of Anesthesiologists (ASA) class, 4) greater BMI, 5) greater body surface area (BSA), 6) cerebrovascular disease (CVD), 7) congestive heart failure (CHF), 8) COPD, 9) diabetes mellitus (DM), 10) decreased cardiac ejection fraction percentage (EF%), 11) emergent (vs. urgent or scheduled) coronary bypass surgery, 12) female gender, 13) hypertension (HTN), 14) left main disease, 15) low output syndrome, 16) higher New York Heart Association (NYHA) class, 17) obesity, 18) pre-operative use of a intra-aortic balloon pump (IABP),

19) pre-operative myocardial infarction (MI), 20) prior heart surgery, 21) rales, 22) peripheral vascular disease (PVD), and 23) renal disease (Grover, Johnson, Marshall, & Hammermeister, 1993). The following text details relevant findings from previous research that are most germane to the proposed study. While most of the research on the CABG population at the time this study was planned had been on men, important differences in womens' referral and recovery for coronary artery bypass (CAB) procedures are beginning to appear in the literature.

Grover, Hammermeister, & Burchfiel (1990) prospectively studied 8,569 VA patients at 47 medical centers in the United States (U.S.). After univariate and multivariate analysis of the non-invasive acute and chronic variables the following rank-ordered variables were identified as the most significant predictors of morbidity and mortality in CAB surgery patients: prior heart surgery, urgent or emergent heart surgery, higher NYHA functional class, peripheral vascular disease (PVD), age, pulmonary rales, current diuretic use, and chronic obstructive pulmonary disease (COPD). However, risk variables from a veteran population may or may not transfer to a general population.

Weintraub, Wenger, Jones, Craver, & Guyton (1993) retrospectively studied another sample of 13,369 at Emory University Hospitals to examine the changing clinical traits of the patients who had CABG's between the years of 1980 and 1991. Multivariate correlates with death were older age, emergent surgery, reduced ejection fraction percentage (EF%), female sex, diabetes, and severe narrowing of coronary arteries in multiple locations. In summary, all of the above named factors can influence morbidity and mortality within the CABG population. For the proposed study this author has selected age and gender as the most influential pre-operative characteristics. Other subject group characteristics and co-morbidities will be described and compared within the data analysis.

Gender

While coronary artery disease (CAD) is the number one killer of women, fewer women than men have been included in CABG research. The unique influence of female hormones and body rhythms on CAB recovery are not completely understood.

There is an additional social factor to consider when evaluating CABG research results related to women. The traditional role of family caretaker that women in American society often assume may influence results and conclusions of past studies. This role can sometimes draw a women back into the homemaking role sooner than is desirable from a recovery perspective and result in incomplete cardiac rehabilitation and poorer functional outcomes.

One published study noted that overall health status improvement after CABG was lower for woman than men (Carey, Cukingnan, & Singer, 1995). This group of researchers noted that women in their sample tended to be older at the time of surgery and have a higher incidence of diabetes. Reasons for a less favorable outcome may include smaller coronary artery size, reduced graft patency and/or delay in diagnosis and referral for surgery until atherosclerotic disease is more severe than their male counterparts.

Another research team explored the influence of female gender and body size on post-CABG outcomes. They studied 7,025 consecutive patients (5,694 men and 1,331 women) who had CABG surgery between 1990 and 1994. Women had a higher incidence of mortality if they were in the lower quartiles of BSA and the higher quartiles of body mass index. For both men and women, small body size may have contributed to low cardiac output syndrome. After the researchers accounted for all pre-operative risk factors and body size, gender remained a significant independent predictor of operative mortality and low-output syndrome (Christakis, et al, 1995).

Age

The influence of advanced age on CABG outcomes has been studied in multiple research projects. Ott, Gutfinger, Miller, Alimadadian & Tanner (1997) compared CABG patients who were 70 years or older to those less than 70 in terms of their response to rapid recovery protocols. Protocols emphasized early extubation post-operatively, reduced cardiopulmonary bypass time, arrhythmia detection and treatment, steroid and thyroid hormone administration, aggressive use of intraaortic balloon pumping pre-operatively, encouraging rapid return of bowel function and mobilization post-operatively. Parsonnet risk scoring (Parsonnet, Dean & Bernstein, 1989) was applied to all subjects to assist in identifying mortality rates. Study results supported the use of the rapid recovery in both older and younger CABG patients, while recognizing that older patients may require a slightly longer period to reach desired outcomes.

Akins, et al (1997) studied 292 consecutive octogenarian patients who had a CABG between 1985 and 1995. This group of researchers found that predictors of hospital death were chronic lung disease, post-operative stroke, pre-operative use of the IABP and congestive heart failure. Predictors of prolonged hospital stay were post-operative stroke and higher New York Heart Association (NYHA) class. The researchers concluded that cardiac operations were successful in most octogenarians, but that clinicians should be aware of the factors that can prolong hospital stays and complications. These patients' long-term survival is strongly influenced by their co-morbid conditions.

During the 1980's the incidence of CABG procedures increased fourfold among those 65 and older in the United States. Mortality rates among "co-morbidity free" octogenarians are as low as 3.5 to 5.5%, provided they had their surgery at a medical center where mortality rates for those under 65 years of age is 2% or less (Safford, 1996).

Clearly, better understanding the influence of co-morbid conditions on CABG outcomes is a priority to offer the best possible care to older people. The proposed study will focus on the post-operative course of patients 65 years and older.

Functional Classification

Patients in the proposed study will have functional classification established pre--operatively. The New York Heart Association's (NYHA) I - IV Classification is the standard used to classify a cardiac patient's functional capacity. By classifying a patient in a standardized way, clinicians caring for the patient can better understand the patient's abilities and more effectively trend improvement or declines in function over time and across therapeutic interventions.

Class I includes patients with cardiac disease who have no limitations on physical activity. Routine exertion does not result in undue fatigue, dyspnea, palpitations or angina. Class II includes patients with cardiac disease who have slightly limited physical capacity. While they are comfortable at rest, routine exertion results in fatigue, dyspnea, palpitations and/or angina. Class III includes patients with cardiac disease who have marked physical limitations with routine exertion. They are comfortable at rest; however, less than regular exertion causes fatigue, dyspnea, palpitations and/or angina. Class IV includes patients with cardiac disease who cannot engage in any physical activity without symptoms. Cardiac insufficiency symptoms and/or angina may be present even at rest. If any exertion is undertaken, symptoms increase (Skov & Underhill Motzer, 1995).

Risk Classification

Health Data Research established the Merged Cardiac Registry (MCR) in 1988. This registry contains data on over 300,000 open-heart surgery cases that are no more than 10 years old at any given time. By using the most recent data the Registry is more

able to assure that patient outcomes are based on current treatment modalities and the most current technology.

The MCR is used to predict untoward patient outcomes during decision-making software knows as Cardiac RiskMaster (version 5.0 was used for this research). Each year approximately 30,000 new OHS cases are added to the registry and the oldest cases are dropped. Cardiac RiskMaster uses MCR data and Bayesian theory to create probability scores for death, near-miss (morbidity), stroke and transfusion. These scores are not intended to replace the clinical judgment of the surgeons, but rather to offer support for informed decision-making by surgeons and patients (Health Data Research, Inc., 1999).

Influence of Comorbid Conditions on CABG Outcomes

A number of comorbid conditions can affect CABG (OPCAB and MIDCAB) patient outcomes. These conditions include diabetes, peripheral vascular disease (PVD), and chronic obstructive pulmonary disease (COPD).

Diabetes Mellitus (DM)

DM is a major contributor to cardiovascular disease. DM doubles the risk for cardiovascular disease in men and triples the risk in women. When the influence of advanced age, hypertension (HTN) smoking, high cholesterol and left ventricular hypertrophy was controlled statistically, diabetes remained as a primary cardiovascular risk factor (Ramen & Neste, 1996).

Diabetes increases morbidity and mortality risks during and after the CABG surgery as well. A meta-analysis concluded the percentage of those who have a CABG with DM as a comorbidity was 6 to 54% (Bhan, Das, Wasir, Kaul, & Venugopal, 1991). The most common types of hospital morbidity in diabetics are often wound infections (Mahar, Singh, Dias, Street, & Aherne, 1995) and post-operative mediastinitis (Antunes,

Bernardo, Eugenio, Oliveria, & Antunes, 1997). Five-year mortality continued to be significantly greater in diabetics than non-diabetics in a recent study, 6.3% and 2.5% respectively (Herlitz, et al, 1996).

Diabetic neuropathy occurs over time and impedes the autonomic conduction of cardiac electrical impulses and sympathetic and parasympathetic stimulation. Neuropathy can also alter patients' pain perceptions and cardiovascular reflexes leaving them more prone to silent cardiac ischemia and a diminished capacity to respond to elevate or lower their heart rate in response to physiological needs.

Post-CABG complications in DM patients are believed to be related to their increased risk for ventricular arrhythmias because of their impaired ability to adjust their heart rate in response to the increased myocardial oxygen demand associated with CABG surgery (rewarming, shivering, activity progression). In addition, autonomic neuropathy can contribute to postural hypotension, altered ability to perceive post-operative pain accurately, and exercise intolerance.

Over time, diabetics will experience changes in the microvasculature of their bodies. These changes occur as a result of thickening of the capillary basement membranes and muscle tissue. These fibrotic changes can cause cardiac muscle to stiffen and ultimately left ventricular function can be negatively affected. This can contribute to the development of post-operative CHF and respiratory dysfunction (Wells, 1993).

Macrovasculature changes in the diabetic patient include atherosclerotic CAD, PVD, cerebral vascular disease and atherosclerotic renal disease. Each of these diseases is associated with elevated cholesterol and the deposit of fatty substances on vessel walls. In addition diabetic patients tend to have higher blood pressure, reduced blood flow, and higher amounts of clotting factors and platelet activity, all of which can contribute to thrombus or emboli formation. Coupled with the clotting risks associated with use of the

cardiopulmonary bypass machine and the hypothermic conditions of the CABG procedure, these patients also have a greater chance of developing pulmonary embolus, CVA, or DVT (Wells, 1993).

Outcomes of diabetic patients having revascularization procedures, either angioplasty or CABG, have been compared in previous research. The 353 diabetic subjects in the total sample of 1,829 participating in the Bypass Angioplasty Revascularization Investigation (BARI), had better long-term survival with CABG procedures than with angioplasty (Anonymous, 1997). Improved outcomes when a CABG was done may have been influenced by the use of internal mammary arteries for bypass(es) versus the practice of compressing an atherosclerotic plaque back against a coronary artery wall (angioplasty). No research regarding outcomes of diabetic patients with OPCAB's or MIDCAB's has been found.

Critical care nurses need sufficient knowledge about the impact of diabetes on CABG, OPCAB and MIDCAB patients to anticipate the risk for altered cardiac output, impaired gas exchange, and embolus formation. In addition, the need for comprehensive diabetes management education is critical to favorable long-term outcomes in these patient populations.

Peripheral Vascular Disease (PVD)

Consistent with atherosclerosis in any location, PVD symptom onset is gradual. Often a narrowing of 50% or greater is present by the time ischemic symptoms appear. PVD is often diagnosed after a work-up for complaints of calf pain after walking. Other signs of ischemia include thinning of the skin and body hair, achiness of the affected limb and peripheral coolness (Porth, 1998).

Generally speaking, patients with PVD have substantially higher mortality rates than those without the disease. This disease-specific mortality has been attributed to

increased risk of coronary artery disease (CAD) and atherosclerosis. Therefore aggressive management of CAD and atherosclerosis is recommended for those who have PVD (Smith, Shipley, & Rose, 1990). After adjusting for confounding variables, Birkmeyer, et al (1996) found that post-CABG patients with PVD were 71 % more likely to die in the hospital than patients without the disease. When the same research group (1996) studied the effect of PVD on long-term mortality over 5 years in 755 (of 2,871 consecutive) CABG patients, they found that patients with PVD had twice the mortality of those without the disease. While a large randomized study of CABG patient outcomes with PVD has not been done to date, it is important for health care providers to recognize the additional risk posed for these patients and respond to related clinical cues promptly to achieve optimal outcomes. No research exploring the impact of PVD on OPCAB or MIDCAB patient populations was found.

Chronic Obstructive Pulmonary Disease (COPD)

COPD includes several respiratory disorders that are characterized by chronic and recurrent air flow obstruction. These disorders include emphysema, chronic bronchitis and some forms of asthma. About 30 million Americans are affected by some form of COPD and this group of conditions remains the fourth leading cause of death in the U.S. (Porth, 1998).

Cigarette smoking and COPD have been positively linked in multiple studies. Smoking remains one of the most significant and preventable causes of morbidity and mortality in the United States. COPD has been implicated as significantly increasing the cause of significant post-operative pulmonary complications in multiple studies, including studies of CABG patients (Dales, Dionne, & Leech, 1993; Joseph & Byrd, 1989; Zibrack & O'Donnell, 1993). The rates of morbidity have not changed appreciably in over three decades, despite advances in anesthetic techniques.

One recent research report indicated that persons who currently smoke (those with and without COPD were included) and who had an elective general, orthopedic, urologic or cardiovascular surgery had a sixfold increased risk of post-operative pulmonary complications than those who never smoked. Interestingly, those who reduced cigarette consumption within the month prior to elective surgery had an even greater risk of pulmonary complication (Bluman, Mosca, Newman, & Simon, 1998). The researchers speculated that this increased risk might be associated with nicotine withdrawal - although no scientific evidence was offered to substantiate this belief.

The negative influence of COPD on CABG outcomes is well documented. In one study, 37 of the 651 subjects had COPD that was being actively treated at the time of CABG surgery. The COPD subjects were matched with 37 control subjects without COPD. Post-operative morbidity and mortality between the two groups was significantly different. The COPD patients had lower forced expiratory volumes, more arrhythmias, higher PaCO2 values, lower PaO2 values, longer intubations, and more reintubations post-operatively, and longer intensive care and hospital lengths of stay overall. Five of the 37 COPD subjects died during the 16 month study follow-up and 17 of the COPD patients reported no improvement in functional capacity within the same follow-up period (Cohen, Katz, Katz, Hauptman, & Schachner, 1995). Control subjects experienced fewer of the complications listed above, had no reported post-operative complications and were all alive at the end of the 16 month follow-up period.

Despite the increased post-operative risks associated with COPD, Bevelaqua, et al (1990) concluded that patients with severe pulmonary impairment, like COPD, should not necessarily be excluded from CABG procedures. These authors' results indicated that persons with obstructive disease do bear more risk (LOS's longer than 7 days) than those with restrictive disease, based on their greater incidence for hypersecretion of mucus,

secretion retention, greater propensity for infection, and increased residual lung volume. Alert critical care nurses can do much to optimize post-operatively pulmonary function - mobilizing and extubating COPD patients as soon as possible after surgery, while maintaining an aggressive pulmonary toilet regimen.

Because of the increased morbidity and mortality risk for patients with COPD having CABG surgery, the less invasive OPCAB and MIDCAB procedures may be a viable alternative. Less time in the operating suite and less intubation time may lessen the risks associated with this comorbidity. However, no research was found that supports this belief. However, Kroenke, Lawrence, Theroux, and Tuley (1992) found a direct relationship between anesthesia time and complications in CABG and abdominal surgery patients with severe COPD. In this patient sample, rates of pulmonary complications jumped from 38% with 2-4 hours of anesthesia to 73% with more than 4 hours of anesthesia. Either statistic would require rapid and systematic intervention on the part of the critical care nurse.

Other Factors that Influence CABG Outcomes

A number of other factors influence CABG patient outcomes. These factors include pre- and post-surgery education and post-hospital rehabilitation.

Pre-surgery Education

Pre-surgery education typically occurs in several different, but presumably complimentary ways. First, the patients (and sometimes the family) are educated in the surgeon's office during the surgical consent process. Second, pre-surgery education occurs in the medical center's Pre-Admission Clinic and is provided by clinic RN's. Content includes information about the surgical procedure, "typical" recovery trajectory and followup care. Pre-operative labs may also be scheduled through this clinic.

Whether or not the patient's family attends these appointments and hears the educational content is variable.

Post-surgery Education

Post-surgery education typically occurs in the intensive care and ward of the medical center in the proposed study and is provided by the RN staff of these areas. Content is organized into a three-ring notebook and additional patient education information can be added based on the patient's individual needs. Whether or not the patient's family hear the educational content and review the three-ring binder content is variable in this setting as well.

Post-hospital Rehabilitation

Jaarsma, Kastermans, Dassen, & Philipsen (1995) used self-structured interviews to describe what problems post-operative CABG patients had struggled with during the first six months after discharge from the hospital. While it is generally agreed that CABG patients need to be educated about risk reduction, stress management, exercise and diet before discharge, decreasing hospital lengths of stay (LOS) change nurse clinicians' ability to do this effectively. Jaarsma, et al's results indicated that all but one of the 82 subjects had experienced problems in one of these four areas: change in physical condition, emotional reaction, deleterious effect of follow-up medical treatment, and post-hospital rehabilitation. Study results indicated additional education was needed in the following areas: knowledge of disease, rehabilitation, physical condition and post-operative treatment side effects.

Whether or not the patients in this study have cardiac rehabilitation after hospital discharge is largely up the them and their family support system. Post-CABG rehabilitation and education is provided within hospitals and at community based programs, such as the YWCA. Duration of these programs ranges from 6 weeks to 6

months. Medicare covers one post-hospital visit to the surgeon; after that, care is assumed by the patient's cardiologist. Patients in this study are routinely referred to the YWCA cardiac rehab program based in the community, but rates of compliance with program attendance and effectiveness of rehabilitation regimens are unknown.

Trajectory/Outcomes for CABG, OPCAB and MIDCAB Patients

Operative Course: CABG'S, OPCAB's and MIDCAB's

Patients having a traditional CABG or OPCAB procedure are premedicated with morphine and diazepam. Patients having the MIDCAB procedure are premedicated with metoprolol and Clonidine. These medications slow the heart rate and decrease anesthesia requirements by 20 - 30%. Ideally the MIDCAB patients have been on beta-blockers for several days pre-operatively to enhance the desired effects. Patients are positioned in a standard supine fashion and pulmonary artery and arterial lines are placed by the anesthesiologist. ECG leads II and V4 are usually used to monitor the heart rhythm since they are able to detect cardiac ischemia accurately about 85% of the time. Emergency external defibrillation pads are placed on the patient's chest wall. Patients receive fentanyl, usually in smaller doses than traditional CABG patients, and have generally higher doses of isofuorane and propofol. Paralysis is usually achieved using rocuronium, a very short acting reversible agent. Patients also receive ketorolac (Toradol) and bupivacaine (Marcaine) intercostal blocks to help with pain management post-operatively. They are usually extubated on the operating room table at the conclusion of surgery.

The incision is made transversely over the fourth rib cartilage, beginning at the sternum and ending at the nipple. Two sheaths are placed in the femoral artery and femoral vein for emergent use should CPB become necessary. The fourth cartilage is removed and the third cartilage is divided. The LIMA is accessed and the patients is

systemically heparinized with 10,000 units. The artery is injected with a combination of verapamil, papaverine and blood to facilitate dilation. The native LAD is "test" occluded for five minutes using tourniquets. This technique establishes patient tolerance and initiates ischemic pre-conditioning.

Ischemic pre-conditioning enhances myocardial protection by a process of inducing brief periods of ischemia followed by restoration of blood flow. Metabolic effects include reducing high energy phosphate catabolism and decreasing lactate and hydrogen ion buildup in the myocardial cells. Adenosine is sometimes used to decrease infarct size and calcium channel blockers limit the entry of calcium into the cells and myocardial damage. Use of Adenosine has decreased since the advent of external epicardial stabilization. This stabilization process can actually eliminate the need for medications like Adenosine (Douville, 1999).

Cardiac Intensive Care Unit (CICU)

CABG, OPCAB and MIDCAB patients in the proposed study return to the Cardiac ICU (CICU) directly from the operating room accompanied by the anesthesiologist, perfusionist and operating room staff. The cardio-thoracic surgeon is immediately available writing post-operative care orders. These patients are staffed with a 1:1 nurse-patient ratio for 6 to 12 hours post-operatively depending on patient stability. Several physiologic challenges that often face the CICU nursing staff when caring for these patient groups include post-operative electrolyte disturbances and replacement; post-operative volume and blood product replacement; and thermoregulation.

A study that examined factors that influence ICU LOS for CABG patients indicated that those with LOS of less than or equal to 1 day were younger (mean 62.39, SD 10.88) and had pre-operative comorbidities such as HTN. Those with LOS of greater than or equal to 2 days were older (mean 68.18, SD 11.84), had pre-operative

comorbidities such as CHF, COPD, EF% of < 50% and needed pre-operative IABP support. Post-operative complications included renal insufficiency, atrial dysrhythmias, low cardiac output syndrome and respiratory insufficiency (Miller, 1998).

Post-operative Electrolyte Disturbances and Replacement

Because all coronary artery bypass (CAB) patients receive varying amounts of crystalloid and colloid solutions, as well as blood products, during surgery and have differing intravascular and renal function, it is quite common for them to have electrolyte disturbances post-operatively. Common imbalances are hypocalcemia, hypomagnesemia or hypokalemia. Physician/nursing protocols contain guidelines for electrolyte replacement and serum electrolyte monitoring. Consequences of prolonged or profound electrolyte imbalances include cardiac arrhythmias, neurological disturbances or death.

Post-operative Volume and Blood Product Replacement

The amount of crystalloid and/or colloids given in the operating room or ICU is usually dependent on the patient's pulmonary artery (PA) and arterial line pressure readings. Adequate blood pressure is necessary to maintain graft patency, but elevated blood pressure may precipitate bleeding on the graft attachment sites. Cardio-thoracic surgeon post-operative orders provide a range or upper and lower limit for blood pressure and a treatment protocol if the range or pressure limit is breached. Depending on SvO2 values, the age of the patient, and other patient factors, blood transfusions are usually ordered if a patient falls below 25% hematocrit.

Thermoregulation

Systemic hypothermia for myocardial protection during surgery has been used since the 1950's. More efficient oxygenators, cardiopulmonary bypass machines and cold cardioplegic solutions have reduced a universal need for systemic hypothermia.

However, patients returning from cardiac bypass surgery may exhibit some degree of hypothermia because of exposure to the cool operating suite temperatures. Critical care nurses must exercise good clinical judgment when rewarming bypass patients to prevent metabolically demanding shivering and guard against precipitous blood pressure drops that may occur if a patient is rewarmed too quickly.

Ward Care, LOS, and Discharge Destination

Patients routinely transfer from the CICU to the cardiology ward before discharging to home. This 30-bed ward is staffed by RN's, LPN's and CAN'S. Care planning and patient education is done by the patient's nurse and the primary nurse on the floor. Length of stay typically ranges from 1 - 3 days for MIDCAB's to 2-5 days for OPCAB's and CABG'S.

The national average LOS for CABG patients is 4.5 days and for MIDCAB patients is 3.0 days (Cardiothoracic Systems WWW site, 1998). National data registries and third-party payors continue to provide benchmarking data that prompts health care providers to shorten hospital LOS to the shortest time (safely) possible. Based on this investigator's clinical observations, most CABG and MIDCAB patients discharge to either their own home or less frequently to a skilled nursing facility (SNF).

Conceptual Framework

The conceptual framework (see Figure 1) depicts the trajectory of the patient groups of interest: CABG and OPCAB. These patients come to these OHS procedures with their own demographic characteristics and comorbidities, all of which can impact their recovery. The trajectory itself includes nursing care received in the preoperative, intraoperative, CICU and ward settings. Nurses in each of these settings are responding to patients' physiological and functional requirements, educating patients and families, and preparing patients for their discharge destination. Nurses have an opportunity to influence physiological, functional, and provider therapy variables in the interest of their patients. Better understanding the recovery experience of each of the groups will enable nurses to improve the care of these patients in the future.

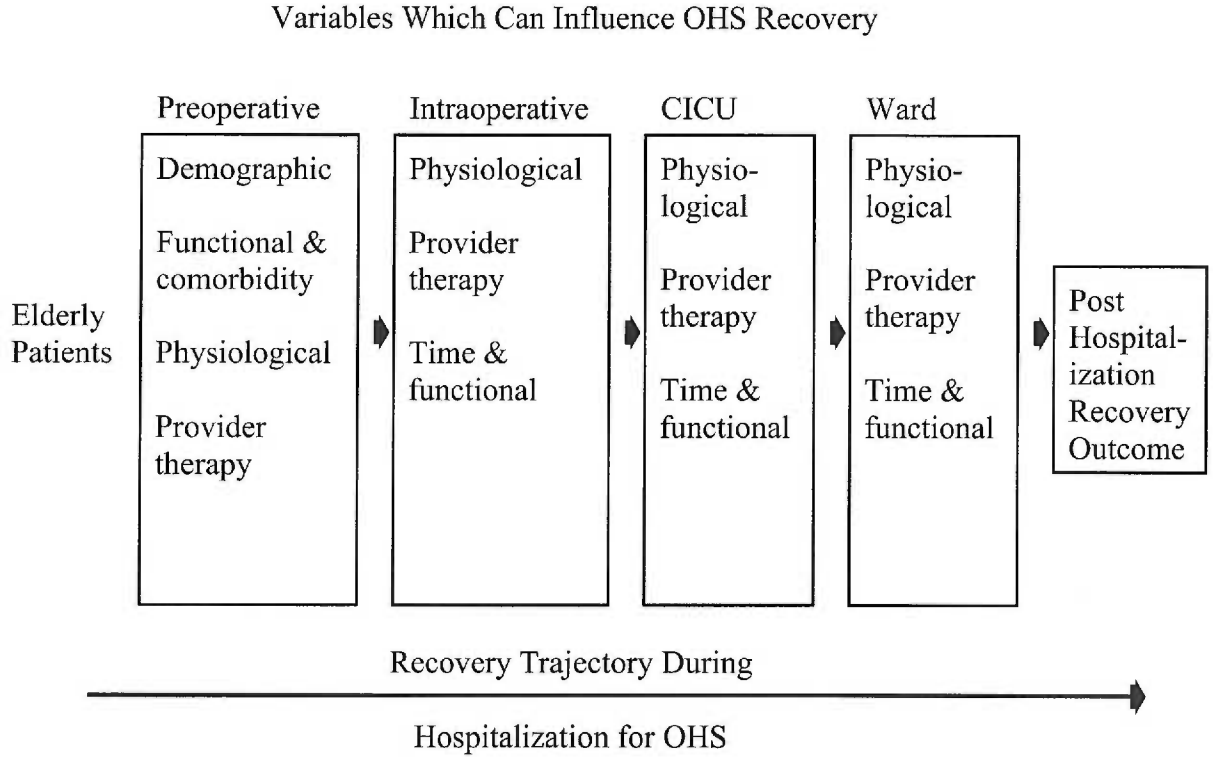
Research Questions

The research questions for this study are:

1. How does recovery of elderly CABG and OPCAB patients compare during the hospital stay?
2. What recovery variation is present between the young-old and old age groups?
3. What recovery variation is present between the elderly male and female patients?

Figure 1

Conceptual Framework



Note. Post hospitalization recovery is not part of this research.

CHAPTER 3: METHODS

Design

A descriptive, comparative design was used because the specific aims (research questions) posed involve two subject groups, OPCAB's and MIDCAB's, which have limited nursing research to date. The CABG subject population has been previously researched extensively by nursing and medicine. The goal in using this type of design was to document similarities and differences between these three CAB groups. Results will also guide the investigator's subsequent program of research.

Setting

All data collection took place in a large tertiary Medical Center in the Northwest portion of the U.S. Medical Center data collection included retrieval of data from the Patient Analysis and Tracking System (PATS) database and manual medical record review. PATS consists of software that allows users to create health care databases (PATS: Axis User manual, 1994).

The Medical Center in the study has had an open-heart surgery (OHS) program for over 20 years and has performed 300-450 OHS's during each of those years. Nurses in the operating room had an average of 7 years experience in intraoperative care; nurses in the Cardiac Intensive Care Unit (CICU) had an average of 8 years of experience in post-OHS care; and nurses on the cardiology ward had an average of 3 years of experience caring for post-OHS subjects during the time of data collection.

Subjects

The original sample size in this research was 68. There were 33 CABG, 32 OPCAB and 3 MIDCAB subjects. Because the MIDCAB subject group was so small, no

analysis beyond description was possible. Therefore final data analysis was done on the 65 subjects in the CABG and OPCAB groups. A description of the MIDCAB group will be presented in one portion of the subsequent text.

Subjects within the remaining two surgery groups were 67 years of age or older and were age and gender matched within groups: 67-74 and 75-86 years. Two subjects were 65 and 86 respectively. Because their LOS, comorbid conditions, hemodynamic parameters and other recovery variables seemed similar to the 75-84 year olds, these two subjects were included in that group. Therefore, when answering specific Aim (Research Question) number two the following designations were used young-old (67 to 74 years) and old (75 to 86 years). The sample was 51 % male and 49% female, 97.5% Caucasian, 2.5% (2 subjects) African-American and 1% Hispanic.

Source of Subjects

Subjects were drawn from the total PATS CABG and OPCAB populations of four cardiothoracic surgeons at the Medical Center. The PATS database was used to track up to 350+ variables/surgery case performed in the Medical Center since the 1980's. The database is maintained by one of the OHS perfusionist at the Medical Center where data collection occurred.

Surgical data beginning on 11/30/99 generated a list of CABG and OPCAB patients sequentially and going back in time was used to select the subjects. The subject with the most recent surgery was selected first. This subject's age and gender were matched to the first subject in the other surgical group who was part of the same age group and who was a gender match. This procedure was repeated until the goal of 30 subjects was met in each group.

In the original plan the researcher hoped to use only one surgeon's cases, but found the volume of cases to be too low in volume to satisfy the number of cases required for statistical significance within an approximately one year timeframe. It was clear from the medical record review that the practice variability between the four surgeons was very limited, making their subjects' recoveries comparable. By keeping the subject selection timeframe to 14 months the risk for other health care professional turnover, environmental changes, and practice changes that could impact study results, was minimized.

Inclusion and Exclusion Criteria

Subjects in the proposed study were subjects admitted to a 485-licensed bed Medical Center in the northwestern U.S. who had a CABG or OPCAB surgery. Inclusion criteria were:

~ admission to the Medical Center for a scheduled CABG or OPCAB

~ 65 years of age or older

~ admission to the operating room and completion of the chest incision

Exclusion criteria were:

~ admission for OHS procedures other than CABG or OPCAB

~ under 65 years of age

~ not able to speak read and write English or understand the informed consent process.

Variables

Variables in the study were collected from the various phases of the OHS trajectory: preoperative, intraoperative, CICU and the cardiology wards. Preoperative

variables were categorized as demographic variables, functional and comorbidity variables, physiological variables and provider therapy variables (See Table 1). Intraoperative variables were categorized as physiological variables, provider therapy variables, and time and functional variables (See Table 2). CICU variables were categorized as physiological variables, provider therapy variables, and time and functional variables (See Table 3). Ward variables were categorized as physiological variables, provider therapy variables, and time and functional variables (See Table 4).

Operational Definitions

Operational definitions for the study variables are presented here in alphabetical order for ease of reference, since some of them were collected in more than one phase of the OHS trajectory.

Age. Age was defined as the age in the PATS database during the Medical Center admission for open-heart surgery. Ages were grouped from 67-74 and from 75-86. There were insufficient subjects aged greater or equal to 85 to form a third group (n=2).

Anesthesia time. Anesthesia time was defined as the number of minutes from induction of anesthesia to the end of anesthesia as documented by the anesthesiologist in the operating room. The anesthesiologist's record was found in the paper medical record during the Medical Center admission for open-heart surgery.

Arrhythmias. Arrhythmias was defined as rhythms other than normal sinus rhythm. Arrhythmias that occurred and were documented during the subject's stay in the Medical Center were categorized as: a) normal, b) atrial arrhythmias, c) ventricular arrhythmias and d) temporary pacing. The subjects who had a permanent pacemaker were included in the normal rhythm category. Data about preoperative arrhythmias were

Table 1

Preoperative Variables Collected for the Study

Demographic Variables
Age
Gender
Marital status
Race
Functional and Comorbidity Variables
ASA scores
Cardiac RiskMaster score
Death
Near-miss
Transfusion
Stroke
Drinking history
EF%
History of arrhythmias
History of chronic pain
Interval since last MI
NYHA class
Preexisting comorbidities
COPD
Hyperlipidemia
HTN
CRF
CRI
BPH
Hypothroidism
Arthritis

Table 1 (Continued)

Preexisting comorbidities
Fibromyalgia
Diabetes - insulin treatment
Diabetes - oral agent treatment
Cancer
Depression
PVD
Pulmonary edema
Cerebral events
Sudden death history
UTI history
Preoperative hours in CICU
Previous cardiac cath interventions
Smoking history
Time since last contrast medium exposure
Physiological Variables
BP : outside 90-140 mm Hg systolic range
BMI category
EF category
Physiological Variables
Laboratory values
Creatinine
Glucose
Hematocrit
K+

Table 1 (Continued)

Provider Therapy Variables
Medications
Beta blockers
ACE
Lipid lowering agent (LLA)
Calcium channel blocker (CCB)
Analgesic
H_2 blocker
Diuretic
Antibiotic
Inhaler
Vitamins
Herbals
Iron
Antithrombotic
Oral agent
Insulin
Nitrate
Proton pump inhibitor
Inotrope
Antiarrhythmic
Hormone
Alpha II blocker
Thyroid
SSRI

Table 2

Intraoperative Variables Collected for the Study

Physiological Variables
Arrhythmias
BP's: outside 90-140 mm Hg systolic range
Code
Output
Urine
Temperature
Provider Therapy Variables
Cardiopulmonary bypass time
Colloid replacement
Cross-clamp time
Crystalloid replacement in OR
Intraaortic balloon pump use
Number of grafts
Transfusions
RBC
Time and Functional Variables
Anesthesia time
Surgical time
Survival to discharge from the OR

Table 3

Cardiac Intensive Care Unit (CICU) Variables Collected for the Study

Physiological Variables
Arrhythmia categories
Arrhythmia duration
BP's: outside 90-140 mm Hg systolic range
Bowel function: first sound categories
Bowel function: stool categories
CLOS
Code
Code status
Delirium
Intraoperative or postoperative MI
Laboratory values
ABG
pH
Co_2
O_2
Ca++
Creatinine
Hematocrit
K+
Mg++
Output:
Blake
Bulb
Chest tube
NG
Urine

Table 3 (Continued)

PA catheter values
Cardiac index
PCWP
Temperature: admission, lowest and highest
Provider Therapy Variables
Colloid replacement
CICU
Consultants
Crystalloid replacement
CICU
IABP use in hours
Insulin IV drip
Mobility to chair
Pain medications
DOS
POD 1
POD 2
POD 3
POD 4
POD 5
POD 6
POD 7
POD 8
POD 9
Reintubation
Pain medications

Table 3 (Continued)

Transfusions
RBC
Platelet
FFP
Vasoactive intravenous medication
Nitroglycerin
Epinephrine
Dopamine
Nipride
Neosynephrine
Dobutamine
Time and Functional Variables
CICU length of stay (LOS)
Extubation, hours until
GCS
First
Last
Morbidity during hospitalization
Mortality during hospitalization
Reoperation incidence
Survival to discharge: CICU
Time as 1:1 status
Time to tubes/lines out
Arterial
Blake
Bulb
Catheter

Table 3 (Continued)

Time to tubes/lines out
Chest
NG
PA
Time to void spontaneously

Table 4

Ward Variables Collected for the Study

	Surgery Groups	Age Groups	Gender Groups
Physiological Variables			
Arrhythmia categories			
Arrhythmia duration			
BP: outside 90-140 mm Hg systolic range			
Code			
Temperature: outside normal range			
Provider Therapy Variables			
Consultants			
Medications			
Beta blockers			
ACE			
Lipid lowering agent (LLA)			
Calcium channel blocker (CCB)			
Analgesic			
H_2 blocker			
Diuretic			
Antibiotic			
Inhaler			
Vitamins			
Herbals			
Iron			
Antithrombotic			
Oral agent			
Insulin			
Nitrate			

Table 4 (Continued)

Medications	
	Proton pump inhibitor
	Inotrope
	Antiarrhythmic
	Hormone
	Alpha II blocker
	Thyroid
	SSRI
Time and Functional Variables	
	Discharge destination
	HLOS
	Survival to hospital discharge

obtained from the surgeon's preoperative history and physical report. Arrhythmias that occurred during a subject's Medical Center were collected from the CICU paper flowsheets and the Ward paper charting from the subject's medical record during the Medical Center admission for open-heart surgery.

Arrhythmia duration. Arrhythmia duration was defined as the length of time an arrhythmia persisted. Arrhythmia duration was collected, when recorded, in hours. Arrhythmias were divided into the following groups: a) normal, b) atrial arrhythmias, c) ventricular arrhythmias and d) temporary pacing. These data were collected from the CICU paper flowsheets and the Ward paper charting from the subject's medical record during the Medical Center admission for open-heart surgery.

Arterial blood gas (ABG) values. ABG values were defined as the assessment of arterial blood to determine the subjects' acid-base, oxygenation and ventilatory status. The pH (normal range 7.35-7.45), CO_2 (normal range 35-35) and O_2 (normal range 70-100) were recorded from the arterial blood gases done in the CICU and recorded in the subject's medical record during the CICU stay. There were a minimal number of ABG values available or legible from the OR record, so analysis was not performed on these ABG's. No ABG's were found during any subjects Ward stay.

ASA score. American Society of Anesthesiologists (ASA) risk score was assigned by the anesthesiologist to patient scheduled for surgery. This is an I-IV scale (V = moribund) with IV indicating "high-risk" for a patient receiving anesthesia. ASA score was written in progress notes of subject chart by the anesthesiologist prior to open-heart surgery. These data were collected from the subject's medical record during the Medical Center admission for open-heart surgery.

Blood glucose values. Blood glucose values was defined as serum or capillary blood glucose levels. Blood glucose values were recorded as frequently as they were found in the CICU. Low blood glucose (hypoglycemia) can trigger altered mentation, dizziness and fainting. High blood sugar (hyperglycemia) inhibits normal tissue function and wound healing.

Blood pressure (BP) range. Normal blood pressure range was defined as 90 - 140 mm Hg systolic. Hypertensive was defined as BP >140 mm Hg systolic and hypotensive was defined as <90 mm Hg systolic. BP ranges were defined based on arterial pressures while the arterial line was present post-operatively (since those are the values treated by the CICU RN's) and cuff pressures after the arterial line was removed post-operatively. These BP's were recorded for the CICU stay was first, highest and lowest. OR blood pressures were recorded as the highest and lowest values and Ward blood pressures were recorded as admission and discharge blood pressures.

Body mass index (BMI) category. BMI was defined using the following standard formula: weight (kg)/height(m)P (P=2). The BMI was calculated using the height and weight recorded in the PATS database during the Medical Center admission for open-heart surgery. BMI groups were established based on NIH Obesity guidelines (NIH, 2000): ideal (19-24.9), obese (25-29.9) and morbidly obese (30-35.0).

Bowel function: Sounds. Bowel sounds was defined as the first marker of the return of bowel function. Bowel function: sounds was recorded as the number of hours until the first documentation of return of bowel sounds after surgery was made in the CICU flowsheet or progress notes or ward computer record.

Bowel function: Stool. Bowel function: stool was defined as the number of days, rounded to the nearest day, until the first recorded stool appeared after open heart surgery. Stools were recorded on the CICU paper flowsheet or the Ward (cardiology ward) computer record in the subject's paper medical record during the admission for open-heart surgery.

Calcium (Ca++) values. Calcium values were defined as total serum calcium. Calcium values were defined as normal, low or high using the serum values in the laboratory records of the subject's medical record during the admission for open-heart surgery. Calcium values were recorded as frequently as they were found during the preoperative and CICU stay. Values were categorized as normal (9.3 – 10.0 gm/dL) low and high using the normal calcium ranges used by the Medical Center in the study.

Cardiac RiskMaster score. The Cardiac RiskMaster Score was defined as the calculated open-heart surgery subject risk for death, near-miss (morbidity), stroke and transfusion using a Bayesian methodology employed at the Medical Center. Death was defined as death during a hospital stay. Near miss is defined as death within 30 days of hospitalization, cerebral damage that does not resolve, requires dialysis or spends more than 14 days in the hospital for any reason. Transfusion is defined as the receipt of human blood products given either during or post operatively: red cells, cryoprecipitate, fresh frozen plasma or platelets. Stroke is defined as transient ischemic attack, and mild or major stroke which the patient may or may not recover from (PATS: Axis SoftWare, 1994). These risk scores were collected from the PATS database for each subject in this study. All cardiac surgery patients Cardiac Riskmaster scores are stored in PATS. Health Data Research established the Merged Cardiac Registry (MCR) in 1988. It contains over

300,000 cardiovascular case. Cardiac RiskMaster was developed based on this data set and is used to predict patient outcomes following open-heart surgery. PATS version 5.0 was used for this study.

Cardio-pulmonary bypass (CPB) time. Cardio-pulmonary bypass time was a time variable defined by the number of minutes a subject was on CPB during open-heart surgery (applies to the CABG groups only). These data were collected from the anesthesiologist record in the subject's medical record from the admission for open-heart surgery.

Cardiac intensive care unit length of stay (CLOS). Cardiac intensive care unit length of stay was defined as the number of days subjects spent in the CICU after discharge from the operating room. The data were collected from the CICU paper flowsheets found in the subject's paper medical record from the Medical Center admission for open-heart surgery.

Code. The health care team members defined a code as a cardiac and/or respiratory arrest that precipitated emergency procedures. Code data were analyzed by occurrence (yes/no) and by a dichotomous survival category (yes/no). Code data were collected from code record forms found in the subject's paper medical record from the Medical Center admission for open-heart surgery.

Code status. Code status was defined as the amount and type of emergency interventions subjects, their family and surgeon determined was appropriate to preserve a subject's life. Default code status was full code, meaning all available emergency procedures were used if a subject's circulatory or respiratory system failed. None of the

subjects fell into the do not resuscitate (DNR) or do not intubate (DNI) groups. Two of the subjects had a code in CICU, but both survived to discharge.

Colloid replacement. Colloid replacement was defined as protein-type intravenous solutions, which were given for the purpose of supporting blood pressure, intravascular volume and/or promoting urine output. Colloid replacements were analyzed by type and volume. These replacement data were collected from the operating room record and the CICU paper flowsheets found in the subject's paper medical record from the Medical Center admission for open-heart surgery.

Comorbidities. Comorbidities were defined as any disease documented in the subject's history or physician's progress notes as existing before open-heart surgery. Comorbidities were collected from the subject's paper medical record from the Medical Center admission for open-heart surgery.

Consultants. Consultants were defined as specialty physicians who provided care to the subjects postoperatively. Use of these consultants was documented on the CICU flowsheets and in the Interdisciplinary Notes in the subject's paper medical record from the Medical Center admission for open-heart surgery.

Creatinine values. Creatinine values were defined as normal (0.6 – 1.3 gm/dL), low or high using recorded values in the laboratory records of the subject's paper medical record during the Medical Center admission for open-heart surgery. Normal and abnormal creatinine values were determined using the normal range used by the Medical Center in the study. Creatinine values were recorded as frequently as they were found.

Cross-clamp time. Cross clamp time was a time variable defined by the number of minutes a subject had his/her aorta clamped during open-heart surgery (applies to the

CABG group only). These data were collected from the anesthesiologist record in the subject's medical record from the admission for open-heart surgery.

Crystalloid replacement. Crystalloid replacement was defined as non-proteinaceous intravenous solution which were given for the purpose of providing hydration, supporting blood pressure, supporting intravascular volume and/or promoting urine output. These replacements were collected from the operating room record and the CICU paper flowsheets.

Day of surgery (DOS). DOS was defined as the calendar date when surgery was completed. This day was determined using the anesthesia record from the subject's paper medical record from the Medical Center admission for open-heart surgery. DOS was used as the anchor point for determining postoperative day's (POD).

Discharge destination. Discharge destination was defined as the location subjects' transferred to after hospital discharge. These data were collected from the discharge sheet in the subject's medical record from the Medical Center admission for open-heart surgery.

Discharge medications. Discharge medications were defined as the prescriptions written by the surgeon when a subject discharged from the Medical Center. These data were collected from the discharge sheet from a subject's medical record from the Medical Center admission for open-heart surgery.

Drinking history. Drinking history was defined based on subjects' self-report to the admitting nurse upon admission to the Medical Center for open-heart surgery. These data were collected from the admission sheet in the subject's medical record from the Medical Center admission for open-heart surgery.

Ejection fraction (EF) % category. EF% was defined as the percentage of blood pumped from the left ventricle through the aorta to the body during systole. Normal EF% is 67%. In the study the subjects were grouped into the following EF% groups: 20-29, 30-39, 40-49, 50-59, 60-69, 70-79 and 80-89%. Ejection fractions were recorded from the physician progress note or physician's history and physical from the subject's paper medical record from the Medical Center admission for open-heart surgery.

Gender. Gender was defined as a dichotomous variable: male or female. Gender was determined using the admission record from the Medical Center admission for open-heart surgery.

Glascow coma scale (GCS) score. GCS score was defined using the standard criteria developed by Teasdale and Jennett (1974). GCS is an item scale is to assess a patient's/subject's level of consciousness and motor responsiveness. The reliability and validity of the scale has been successfully tested in a variety of settings (Sisson, 1990). Scores from the four subscales are summed to determine a total score. Total scores can range from 3 (obtundation) to 15 (oriented and verbalizing appropriately). First and final GCS scores recorded on the CICU paper flowsheet were collected and compared with the nurse's narrative description of cognitive status to determine whether a neurological complication occurred during surgery or the CICU stay. These data were collected from the subject's paper medical record from the Medical Center admission for open-heart surgery.

Hematocrit values. Hematocrit values were defined as normal (40.0-53.0 gm/dL), low or high using the recorded hemoglobin values in the laboratory records of a subject's paper medical record during the Medical Center admission for open-heart surgery.

Normal and abnormal values were determined using the normal hemoglobin range used by the Medical Center in the study.

Hemoglobin values. Hemoglobin values were defined as normal (13.5-17.7 gm/dL), low or high using the recorded hemoglobin values in the laboratory records of a subject's paper medical record during the Medical Center admission for open-heart surgery. Normal and abnormal values were determined using the normal hemoglobin range used by the Medical Center in the study. Hemoglobin values were recorded as frequently as they were found in the subject's paper medical record from the Medical Center admission for open-heart surgery.

History of arrhythmias. History of arrhythmias was defined as a yes/no dichotomous variable. Arrhythmias were categorized as: a) normal, b) atrial arrhythmias, c) ventricular arrhythmias and d) temporary pacing. The subjects who had a permanent pacemaker were included in the normal rhythm category. These data were recorded from the surgeon's history and physical report in the subject's paper medical record from the Medical Center admission for open-heart surgery.

History of chronic pain. History of chronic pain was defined as a yes/no dichotomous variable. Chronic pain caused by previous injury or a chronic illness was recorded from the physician's history and physical in the subject's paper medical record from the Medical Center admission for open-heart surgery.

Insulin intravenous (IV) drip. Insulin intravenous drip was defined as the use (yes/no) of a continuous insulin IV drip to keep blood sugars less than 200 gm/dL (surgeon defined parameter). These data were collected from the CICU flowsheet in the

subject's paper medical record from the Medical Center admission for open-heart surgery. Insulin drips were not used for subjects during Ward stays.

Interval since last MI. Interval since last MI was defined for subjects who had a MI prior to admission to the Medical Center for open-heart surgery. These data were expressed in groups (none, one or two) and collected from the PATS database.

Intraaortic balloon pump (IABP) use time. IABP use time was defined as the use of an IABP to support the cardiac and circulatory system. IABP was analyzed in hours and rounded to the nearest day as appropriate. Use of an IABP was determined using the nurse's notes from the operating room records and the paper medical record from the CICU. These data were collected from the subject's paper medical record from the admission for open-heart surgery.

Intraoperative or postoperative MI. Intraoperative or postoperative MI was defined as a physician diagnosed MI during the OR, CICU or ward stay. These data were collected from the physician's progress record from the subject's paper medical record from the admission for open-heart surgery.

Length of stay: CICU (CLOS). CLOS was defined as the number of days, rounded to the nearest tenth, that a subject was cared for in the CICU. These data were collected from the CICU paper flowsheets during the subject's Medical Center admission for open-heart surgery.

Length of stay: Medical center (HLOS). HLOS was defined as the number of days that the subject was a patient in the Medical Center where this study was conducted. These data were collected from the subject's paper medical record from the Medical Center admission for open-heart surgery.

Length of stay: Ward. Ward LOS was defined as the number of days that a subject was cared for on the ward after discharge from CICU. Days were calculated by subtracting the number of days a subject was cared for in CICU from the HLOS, based on the subject's paper medical record from the Medical Center admission for open-heart surgery.

Magnesium (Mg^{++}) values. Magnesium values were defined as normal (1.7-2.5 gm/dL) low or high using the recorded serum values in the laboratory records of the subject's paper medical record during the admission for open-heart surgery. Normal and abnormal magnesium values were determined using the normal magnesium range used by the Medical Center in the study. Magnesium values were recorded as frequently as they were found during preoperative and CICU stay.

Marital status. Marital status was defined in groups: single, married, divorced, separated or widowed. Data were collected from the Medical Center admission record from the subject's paper medical record during the admission for open-heart surgery.

Medications. Medications were defined based on the following groups a) preoperative, b) CICU (vasoactive, insulin and morphine sulfate equivalencies) and c) ward (morphine sulfate equivalencies) and d) discharge categories. Preoperative medications include all classes recorded in the surgeon's history and physical. CICU medications included any vasoactive medications, intravenous (IV) insulin drips or morphine sulfate equivalent received postoperatively while the subject was in the CICU. These medications were determined using the CICU paper flowsheet. Vasoactive medication was defined as intravenous medication administered using an infusion pump for the purpose of optimizing blood flow, cardiac output or supporting or modifying

blood pressure. Discharge medications were found on the discharge sheet and were written by the surgeon. All these records were located in the subject's paper medical record from the admission for open-heart surgery.

Mobility to chair. Mobility was defined in one manner: up to the chair. This is the only descriptor that was consistently documented in the subject records during the CICU or ward stay. This data was recorded in hours and was collected from the CICU paper flowsheets.

Morbidity during medical center stay. Morbidity was defined during the proposal phase of this research morbidity was defined using Higgins (1997) definition when one or more of the following complications appeared in a subject's paper medical record from the Medical Center admission for open heart surgery: 1) cardiac index less than two liters per minute, despite vasoactive support; 2) myocardial infarction documented by CK-MB fraction elevation during or after surgery; 3) IABP use after surgery; 4) ventilator support longer than 24 hours after arrival to the CICU or reintubation after post-surgical extubation; 5) documented (per CT, MRI or neurologist evaluation) stroke; 6) renal failure requiring the use of dialysis; and 7) serious infection of wound or body system. Documentation from the CICU paper flowsheet, the Ward computer records and from the physician's progress notes were used to determine if one of these morbid conditions occurred during the OHS stay. Additional morbidities was redefined to include: respiratory failure, pneumonia, AICD placement and others.

Mortality during medical center stay. Mortality during Medical Center stay was defined as death during the Medical Center stay for OHS. No mortality occurred in this study.

New York Heart Association (NYHA) class. NYHA class was defined using the standard four functional cardiac classes developed by the New York Heart Association in 1964 (Skov and Underhill Motzer, 1995). Class descriptions were consistent with those previously described in this text. NYHA class was collected from the CardioVascular Lab (CVL) data sheets, PATS and the physician's notes from the subject's medical record from the admission for open-heart surgery.

Number of grafts. Number of grafts was defined as the number of bypass grafts attached by the surgeon to a subject heart. These data were taken from the surgeons' progress note after OR from the subject's medical record from the Medical Center admission for open-heart surgery.

Output. Output was defined as any drainage from any of the following natural or artificial routes and was described as in cc amounts. Output data were collected from the operating room notes and the CICU paper flowsheet. All recorded output from the subject's paper medical record was collected for the Medical Center admission for open-heart surgery.

Output: Bulb suction. Bulb suction output was defined based on the use of a drainage system, which relies on a compressed bulb shaped container to exert negative pressure and promote drainage, e.g. bulb suction drains used were used to drain surgical sites in lower leg(s).

Output: Blake. Blake drains are used as an alternative to conventional chest tubes to drain the mediastinal space after surgery. They are smaller in diameter than conventional chest tubes and are perceived by nurses as painful to remove.

Output: Chest tube. Chest tube output was defined as conventional #36 French chest tubes placed at the end of surgery to drain post-operative fluid into a drainage collection system that may or may not have negative suction attached.

For the purposes of analysis, all blood drainage was grouped together: Bulb, Blake and chest tube.

Output: Emesis. Emesis output was defined as the cc of emesis vomited or the number of episodes of emesis when the cc of emesis could not be measured. While nausea was recorded for several subjects, emesis was not.

Output: Nasogastric (NG) tube. NG tube output was defined as the cc of suctioned nasogastric drainage when a NG tube was placed postoperatively. This output was analyzed as gastric output.

Output: Urine. Urine output was defined as the cc of urine which drained into a fluid collection bag or which the subject voided spontaneously.

Postoperative day (POD). POD was defined using the 24-hour clock from midnight to midnight. Regardless of what time a subject returned from surgery, s/he was considered POD #1 after the first midnight period in CICU. Every subsequent midnight advanced the POD calculation forward by an additive value of one. POD's were calculated using the CICU paper flowsheet and the Ward computer record from the Medical Center admission for open-heart surgery.

Potassium (K^+) values. Potassium values were defined as normal (3.7-5.5 gm/dL), low or high using the recorded serum values in the laboratory records of the subject's paper medical record from the Medical Center admission for open-heart surgery. Potassium value groups were determined using the normal range used by the

Medical Center in the study. Potassium values were recorded as frequently as they were found during the preoperative and CICU stay.

Preoperative hours in CICU. Preoperative hours in CICU were defined as the number of hours subjects were in the CICU before surgery. These data were collected from the CICU flowsheets from the subject's medical record from the Medical Center admission for open-heart surgery. 15 of the subjects were in CICU preoperatively.

Pulmonary artery catheter (PAC), Cardiac index and (CI) Pulmonary artery wedge pressures (PCWP). CI was defined as the estimate of blood flow through the aorta in relation to the body surface area (BSA). PCWP is defined as an indirect means of estimating left heart preload. (AACN Reference Manual, 1998). These two values together provide health care professionals a solid indication of how a left ventricle is performing and are the basis for some treatment decisions. CI and PCWP's were collected as frequently as they were recorded on the CICU paper flowsheets from the subject's admission for open-heart surgery. CI < 2.0 liters/min with a PCWP > 18 mm Hg formed the definition of a compromised left ventricle after the first CI/PCWP were recorded after CICU admission.

Race/ethnicity. Race was defined using Medical Center definitions of the following racial/ethnic groups: white, non-Hispanic; white Hispanic; African-American; African Non-American; Asian; Native American; or South Pacific Islander. These data were taken from the subject's Medical Center admission form in the subject's paper medical record from the Medical Center admission for open-heart surgery.

Reintubation. Reintubation was defined as the placement of an endotracheal tube (ETT) in the subject for the purpose of supporting oxygenation after the ETT placed

before open-heart surgery was removed. This is a yes/no dichotomous variable. These data were collected from the CICU paper flowsheets and the physician progress notes in the subject's paper medical record from the admission for open-heart surgery.

Reoperation incidence. Reoperation incidence was defined as the subject's return to the operating room for any reason after s/he had been admitted to CICU. This is a yes/no dichotomous variable. These data were collected from the CICU paper flowsheets completed during the subject's Medical Center admission for open-heart surgery. There were no reoperations in this sample.

Smoking currently. Smoking currently was defined as the subject's self-report documented by the physician in the history and physical or the nurse's clinical admission form in the subject's paper medical record of the Medical Center admission for open-heart surgery.

Smoking history. Smoking history was defined as the subject's self-reported pack-years or as documented in the physician's history and physical in the subject's paper medical record from the admission for open heart surgery. The smoking categories from the PATS database were used in this study: never smoked, smoking now, quit within the past 6 months and quit more than 6 months ago. Of the subjects who had ever smoked, there was not consistently enough data to calculate pack-years.

Surgical time. Surgical time was based on the number of minutes documented by the anesthesiologist as surgery time on the anesthesia record from the operating room. Surgical time was collected from the PATS database from the subject's Medical Center admission for open-heart surgery.

Survival to discharge from CICU. Survival to discharge from CICU was defined as subject survival from the time of admission to CICU to the transfer to the floor using dichotomous yes/no groups. These data were collected from the CICU paper flowsheets in the subject's paper medical record from the Medical Center admission for open-heart surgery. All subjects survived to transfer to Ward.

Survival to discharge from the operating room. Survival to discharge from the operating room was defined as subject survival through any open-heart surgery operative period during the Medical Center stay for open-heart surgery. This is a yes/no dichotomous variable. These data were collected from the physician's progress notes from the subject's paper medical record from the admission for open-heart surgery. All subjects survived to discharge from the operating room.

Time of 1:1 nursing care. Time as 1:1 status was determined based on the amount of time each post open-heart surgery subject required 1:1 nursing care. Reasons for 1:1 nursing care include hemodynamic instability, titration of vasoactive medications, frequency of vital sign monitoring and staffing levels. This time calculated in minutes and was determined based on data recorded on the CICU paper flowsheets: vital sign monitoring every 15 minutes or less, evidence of fluid or blood product resuscitation, presence of an IABP (automatic 1:1 status in CICU). Time as 1:1 status was collected from the subject's paper medical record from the Medical Center admission for open-heart surgery.

Time since last contrast medium exposure. Time since last contrast medium exposure was defined as the number of days since a subject had received radio-opaque contrast for a diagnostic procedure. Contrast intake can negatively impact renal function

in vulnerable subjects. These data were collected from the CVL record from the subject's paper medical record from the Medical Center admission for open-heart surgery.

Time to extubation. Time to extubation was defined as the number of hours until the subject's endotracheal tube (ETT) was removed after open-heart surgery. These data were collected from the anesthesiologist's record or the CICU paper flowsheet from the subject's Medical Center admission for open-heart surgery.

Time until lines out: Arterial, central and/or PA. Time until arterial, central and/or PA line(s) were removed was defined as the number of hours until each line present was removed after arrival to the CICU. These data were collected from the CICU paper flowsheet(s) from a subject's paper medical record from the Medical Center admission for open-heart surgery.

Time until tubes out: Blake, bulb, NG or catheter. Time until Blake, bulb, NG and/or catheter tubes were removed was defined as the number of hours until each line present was removed after arrival to the CICU. These data were collected from the CICU paper flowsheet(s) from a subject's paper medical record from the Medical Center admission for open-heart surgery.

Time to void spontaneously. Time to void spontaneously was defined as the number of hours that it took for a subject to void spontaneously after an indwelling urine catheter was removed. This time was calculated by subtracting the time a subject voided spontaneously from the time the indwelling urine catheter was removed. These data were collected from a subject's paper medical record from the Medical Center admission for open-heart surgery.

Transfusions. The number and type of blood products given to support hematocrit, blood pressure and/or urine output defined transfusions. Transfusions included packed red blood cells, fresh frozen plasma or platelets. These data were recorded from the anesthesia record, the CICU paper flowsheets from the subject's paper medical record from the Medical Center admission for open-heart surgery.

Ward stay. Ward stay was defined as the length of stay subjects spent on a cardiology ward after discharge from CICU in days. These data were collected from a subject's paper medical record from the Medical Center admission for open-heart surgery.

Instruments

The instruments designed by the investigator which were used in the study were the Preoperative Data Collection Form (PDCF), the Intraoperative Data Collection Form (IDCF), the CICU Data Collection Form (CDCF), and the Ward Data Collection Form (WDCF) and the SPQ (see Appendix A-D). These forms were used to facilitate data retrieval from the paper medical record and PATS (Patient Analysis and Tracking System; Dendrite, Inc.) database. Data were collected until all specified variables were complete to the greatest extent possible. The PDCF, IDCF, CDCF and WDCF were refined by pilot testing them on two OHS subject records prior to the beginning of the study.

Reliability of Data

While the potential inaccuracies of a paper-based medical record were present, the emphasis on trained health care providers documenting subject characteristics and progress accurately and legibly is great, based on legal and regulatory requirements.

Retrospective use of medical record data is often used to inform Medical Center-based quality improvement activities or in the conduct of health care research (Bevelaqua, et. al., 1990; Cane, et.al., 1995; Christakis, et.al., 1995).

Human Subjects

The Institutional Review Board (IRB) at Providence Portland Medical Center (PPMC) and the Oregon Health Sciences University (OHSU) Office of Research Services (ORS) prior to data collection approved this proposal. No modifications requiring an addendum review by the IRBs were made. Risk to subjects was minimal. Potential risks included risk for breach of subject confidentiality when subject names and medical records were accessed. The following minimized the risk for breach in subject confidentiality: all subjects were assigned a numeric designation based on their random position in the PATS database. The master list of subject names, addresses and code numbers was stored on a single computer diskette and was kept in a locked file drawer until the completion of the study; and all data collection forms contained only the subject number and were kept in a locked file drawer when not in the immediate possession of the investigator. When the study is completed, all subject identifiers will be destroyed.

Access to data from the paper medical record and PATS database was authorized based on the quality improvement mission of the Medical Center. Data are often used to help describe subject care in a variety of internal and externally driven quality improvement or research projects.

To maintain confidentiality, only subject numbers were entered into the SPSS database. When the forms and questionnaires were not in the immediate possession of the investigator, they were kept in a locked file drawer. After post-dissertation QOL

analysis (not described in this dissertation) is complete, all paper and diskette records bearing subject identifiers will be shredded or deleted.

Procedures

Subjects were identified by the OR perfusionist who maintains the PATS database of CABG and OPCAB (and other) patients. Starting from 11/30/99, he queried the database going back in time 14 months to identify all eligible subjects aged 65 and older. All four surgeons were included to satisfy the number of subjects needed per group. Based on review of postoperative OHS orders, there is very little practice variability (PATS outcome analysis by surgeons, 1996-2001) between the four surgeons based on blood pressure parameters, types of blood products, crystalloids and colloids used or CICU transfer criteria.

CABG and OPCAB subjects were matched by age group, gender group, as previously described. After the subjects were identified in age and gender-matched pairs, printouts of each subject's data base information were generated. These data were used to validate paper medical record data and provide data not found in the paper medical record. Agreement between the PATS and the paper medical record was excellent, with only 27 differences noted out of more than 2400+ possible variables, representing a 0.12% variation. Data were used to complete the PDCF, IDCF, CDCF and WDCF. Subject names and addresses were removed from the printouts and replaced with code numbers. The investigator transcribed all subject data in a private location in order to protect subject confidentiality. Only subject code numbers were kept on the data collection forms. When the PATS database forms and data collection forms were not in

use and in the immediate possession of the investigator, they were kept in a locked file drawer.

The frequency of measurement of the variables is summarized in Table 5. The sources of the variables are listed in Table 6.

Data Analysis

After data collection was completed, the PATS and paper medical record data were entered into SPSS 10.0 (SPSS, Inc., 2000) program for analysis. The researcher verified data reading back entered variables and rechecking the data collection forms to assure the values were the same. Data were analyzed using SPSS version 10.0 and frequency tables, descriptive and comparative testing was done. Significance level was initially established at $p = .05$, but based on the number of tests run and the recommendation of the dissertation committee the significance level was elevated to $p = .01$, to decrease the chance of achieving statistical significance by chance. The significance levels are presented but are not intended to be conclusive because this is not hypothesis testing research. The statistical and clinical significance levels in this research suggest trends, but additional directional research (hypothesis testing) would be essential to reach scientific conclusions.

Table 5

Variables: Frequency of Collection and Type of Measurement

Name of Variable	Frequency & Type of Measurement
Age	Once
Albumin values	Every time it appeared
Anesthesia time	Once (more if there was a reoperation)
Arrhythmia categories	Every time rhythm was other than normal: type/hours
Arrhythmia duration	Every time it appeared
Blood gluceose values	Every time it appeared in CICU: serum or capillary and time
BP: admission and discharge	Every time it appeared on ward
BP: category	Admission and discharge on ward; highest and lowest in OR
BP	Outside 90-140 mm Hg range each time it occurred
BMI category	Once, based on hospital admission height and weight data
Bowel function: sounds	Once, when sounds return/hours
Bowel function: stool	Once, with first stool/POD
Cardiopulmonary bypass time in minutes	Every time it occurs
Code	Every time it occurs
Code status	Every time it changes from full code status
Colloid replacement	Sum of post-op volume
Consultants	Every time they appear: type and POD
Crystalloid replacement	Sum of post-op volume
Day of surgery (DOS)	Once, more if there is a reoperation
Delirium	Every time symptoms were described
Discharge destination	Once, from discharge shet

Table 5 (Continued)

Name of Variable	Frequency & Type of Measurement
Discharge medications	Once, from discharge sheet
EF%	Once, more if there is a perioperative MI
Gender	Once
Hematocrit	Every time it appears, time and POD
History of arrythmias	Once/type
HLOS	Once: days
IABP use	Every time it appears: hours to days, rounded to quarter hours
Laboratory values: ABG, albumin, BUN, creatinine, hematocrit, K+ and Mg++	Every time it appears during the preadmission, OR and CICU stays
Marital status	Once, on hospital admission for OHS
Medications vasoactives	Every time they appear: drug type/duration
Mobility	Every time category changes and POD
Morbidity during hospitalization	Every time criteria were met
Mortality during hospitalization	Once
NYHA class	Once, based on hospital admission data
Output	Every 8 hours (24, 08, and 1600) and POD
Parsonnet's risk score	Once, based on hospital admission data
POD	With each date change at 2400
Postoperative comorbidities	Each time new one was identified
Preexisting comorbidities	Once
PA catheter values	CI and PCWP with each cardiac output measurement
Race	Once
Reintubation	As often as it occurred
Reoperation incidence	As often as OHS reoperation occurred

Table 5 (Continued)

Name of Variable	Frequency & Type of Measurement
Reoperatiopn reason	As often as provided
Smoking currently	Once
Smoking history	Once
Surgical time	As often as it appeared for OHS
Survival to d/c from hospital	Once
Survival to d/c from CICU	As often as it appeared
Temperature, out of range	As often as < 35 degrees of > 38 degrees
Time as 1:1 status	As often as it occurred
Time since last contrast mediumm exposure	Once
Time to extubation	As often as intubation occurred
Time to lines out	Once
Time to void spontaneously	As often as an indwelling urine catheter was placed
Transfusions	Every time given: type, POD
Ward LOS	Once: total days

Table 6

Variables: Source of Data

Name of Variable	Source of Data
Age	PATS
Albumin values	Paper medical record
Anesthesia time	Paper medical record
Arrhythmias	Paper medical record
Blood gluceose values	Paper medical record
BP: admission and discharge	Paper medical record
BP: category	Paper medical record
BP: first, highest and lowest (systolic)	Paper medical record
BMI category	Calculated based on paper medical record values
Bowel function: sounds	Paper medical record
Bowel function: stool	Paper medical record
Cardiopulmonary bypass time in minutes	Paper medical record
CLOS	Paper medical record
Code	Paper medical record
Code status	Paper medical record
Colloid replacement	Paper medical record
Consultants	Paper medical record
Crystalloid replacement	Paper medical record
Day of surgery (DOS)	Paper medical record
Delirium	Paper medical record
EF%	Paper medical record
Gender	PATS
Hematocrit	Paper medical record
History of arrythmias	Paper medical record
HLOS	PATS

Table 6. (Continued)

Name of Variable	Source of Data
IABP use	Paper medical record
Laboratory values: ABG, albumin, BUN, creatinine, hematocrit, K+ and Mg++	Paper medical record
Marital status	PATS
Medications	Paper medical record
Mobility	Paper medical record
Morbidity during hospitalization	Paper medical record
Mortality during hospitalization	Paper medical record
NYHA class	Paper medical record
Output	Paper medical record
Parsonnet's risk score	PATS
POD	Paper medical record
Postoperative comorbidities	Paper medical record
Preexisting comorbidities	Paper medical record
PA catheter values	Paper medical record
Race	PATS
Reintubation	Paper medical record
Reoperation incidence	Paper medical record
Reoperatiopn reason	Paper medical record
Smoking currently	Paper medical record
Smoking history	Paper medical record
Surgical time	Paper medical record
Survival to d/c from hospital	Paper medical record
Survival to d/c from CICU	Paper medical record
Temperature	Paper medical record
Time as 1:1 status	Paper medical record

Table 6. (Continued)

Name of Variable	Source of Data
Time since last contrast medium exposure	Paper medical record
Time to extubation	Paper medical record
Time to lines out	Paper medical record
Time to void spontaneously	Paper medical record
Transfusions	Paper medical record
Ward LOS	PATS

CHAPTER 4: RESULTS OF STUDY

A brief description of the total sample was provided in Chapter 3. Table 7 presents demographic data for the total sample of 65 subjects. Mean age of the total sample was 75 years with approximately 50% male and 50% females. Most of the subjects were married, Caucasian and all resided in their own home.

This narrative of the Results chapter will be organized based on the OHS time continuum (variable categories) used in Chapter 3: a) Preoperative Variables: demographic, functional and comorbidity, physiological and provider therapy; b) Intraoperative Variables: physiological, provider therapy and time and functional; c) CICU variables: physiological, provider therapy and time and functional; d) Ward Variables: physiological, provider therapy and time and functional. Within the variable categories analyses were performed based on a) surgery groups (CABG vs. OPCAB), b) age groups (67-74) vs. (75-86) and c) gender groups (male vs. female). Results will then be discussed based on statistically significant findings; clinically significant differences; and items that did not reach either of the two previous levels but were of interest to health care professionals. Statistically significant findings are those which reached p= .010 level; clinically significant findings have p values between p= .010 through p= .065.

Preoperative Period

Surgery Groups

Descriptive data for preoperative variables of the surgery groups are presented in Table 7. Preoperative medication and discharge medication classes are presented later in

Table 7

Preoperative Variables: Descriptive Data for Surgery Groups

Variables of Comparison	Total sample N=65	CABG N=33	OPCAB N=32
Preadmission Demographic Variables			
Subject age range (mean)		75.7 +- .93	75.0 +- .94
Minimum-maximum	67-86	67-85	67-86
Gender			
Male	33 (51%)	16 (48%)	17 (53%)
Female	39 (60%)	20 (61%	19 (59%)
Marital Status			
Single	5 (5%)	2 (6%)	1 (3%)
Married	39 (60%)	20 (61%)	19 (59%)
Divorced	4 (6%)	2 (6%)	2 (6%)
Widowed	19 (29%)	9 (27%)	10 (31%)
Separated	0	0	0
Race			
Caucasian	62 (95%)	31 (94%)	31 (97%)
African-American	2 (3%)	2 (6%)	1 (3%)
Hispanice	1 (2%)	1 (3%)	0
Functional and Comorbidity Variables			
Preoperative arrhythmias			
None	56 (86%)	29 (88%)	27 (84%)
Atrial fibrillation	6 (9%)	2 (6%)	4 (13%)
PVC's	2 (3%)	1 (3%)	1 (3%)
Pacer	1 (2%)	1 (3%)	0

Table 7 (Continued)

Variables of Comparison	Total sample N=65	CABG N=33	OPCAB N=32
History of chronic pain			
None	58 (89%)	33 (100%)	25 (84%)
Arthritis	6 (9%)	0	5 (16%)
Other	1 (2%)	0	2 (5%)
Riskmaster			
Near miss mean, range	3.07-54.99	3.07-35.39	3.86-54.99
Death mean, range	.88-28.55	1.18-18.01	.88-28.55
Stroke mean, range	.93-17.07	1.28-11.65	.93-17.07
Transfusion mean, range	.83-5.73	.83-5.62	.65-5.73
Comorbidity			
COPD	12 (18%)	4 (12%)	8 (25%)
Hyperlipidemia	34 (52%)	20 (61%)	14 (44%)
HTN	40 (62%)	21 (64%)	19 (59%)
Chronic renal failure	2 (3%)	1 (3%)	1 (3%)
Chronic renal insufficiency	3 (5%)	2 (6%)	1 (3%)
BPH	3 (5%)	0	3 (9%)
Hypothyroidism	8 (12%)	4 (12%)	4 (13%)
Arthritis	9 (14%)	3 (9%)	6 (19%)
Fibromyalgia	1 (2%)	0	1 (3%)
Diabetic:			
Oral agent	11 (17%)	6 (18%)	5 (16%)
Insulin	5 (8%)	3 (9%)	2 (6%)
Cancer	7 (11%)	4 (12%)	3 (9%)
Depression	5 (8%)	3 (9%)	2 (6%)
PVD	7 (11%)	4 (16%)	3 (9%)
Pulmonary edema history	0	0	0

Table 7 (Continued)

Variables of Comparison	Total sample N=65	CABG N=33	OPCAB N=32
Comorbidity			
Cerebral events	5 (5%)	1 (3%)	4 (12%)
Sudden death history	2 (3%)	1 (3%)	1 (3%)
UTI	2 (3%)	0	2 (6%)
Previous MI			
None	41 (63%)	21 (62%)	20 (62%)
One	20 (31%)	9 (27%)	11 (34%)
Two	4 (6%)	3 (9%)	1 (3%)
Smoking status			
Never smoked	37 (57%)	20 (61%)	17 (53%)
Smoking now	7 (11%)	3 (9%)	4 (13%)
Smoking within the last 6 months	1 (2%)	1 (3%)	0
Quit over 6 months ago	20 (31%)	9 (27%)	11 (34%)
ETOH use			
No reported drinking	60 (92%)	30 (91%)	30 (94%)
0-2 drinks/day	4 (6%)	2 (6%)	2 (6%)
"heavy" > 5 years ago	1 (2%)	1 (3%)	0
Contrast medium exposure to OR time in days			
Mean (SE)	7.5 (2.07)	6.3 (3.0)	8.7 (2.9)
Median	1.0	1.0	1.0
Range	0-92	0-92	0-57

Table 7 (Continued)

Variables of Comparison	Total sample N=65	CABG N=33	OPCAB N=32
Physiological Variables			
Blood pressure category			
Normotensive	54 (83%)	27 (82%)	27 (84%)
Hypotensive	0	0	0
Hypertensive	11 (17%)	6 (18%)	5 (16%)
Body mass index (BMI)			
19-24.9 ideal	23 (35%)	9 (27%)	14 (44%)
25-29.9 obese	22 (32%)	15 (45%)	7 (22%)
> 30.0 morbid obese	16 (25%)	6 (18%)	9 (28%)
Missing data	5 (8%)	3 (10%)	2 (6%)
Ejection fraction %			
20-29%	2 (3%)	0	2 (6%)
30-39%	8 (12%)	5 (15%)	3 (9%)
40-49%	7 (11%)	5 (15%)	2 (6%)
50-59%	8 (12%)	5 (15%)	3 (9%)
60-69%	19 (29%)	12 (36%)	7 (22%)
70-79%	19 (29%)	5 (15%)	14 (44%)
80-89%	2 (3%)	1 (3%)	1 (3%)
NYHA classification			
None/missing data	16 (25%)	7 (21%)	9 (28%)
I	31 (48%)	14 (42%)	17 (53%)
II	7 (11%)	6 (18%)	1 (3%)
III	7 (11%)	6 (18%)	1 (3%)
IV	2 (3%)	0	2 (6%)

Table 7 (Continued)

Variables of Comparison	Total sample N=65	CABG N=33	OPCAB N=32
Preoperative hemoglobin			
Normal (13.5-17.7 g/dL)	27 (42%)	14 (42%)	13 (40%)
Below normal	32 (49%)	18 (56%)	14 (43%)
Above normal	0	0	0
Missing data	6 (9%)	1 (3%)	5 (2%)
Preoperative hematocrit			
Normal (40.0-53.0 g/dL)	27 (45%)	8 (21%)	19 (59%)
Below normal	30 (47%)	23 (79%)	7 (22%)
Above normal	0	0	0
Missing data	8 (9%)	6 (18%)	2 (6%)
Preoperative glucose			
Normal (80-119 mg/dL)	24 (37%)	12 (36%)	12 (38%)
Hyperglycemia	18 (28%)	8 (24%)	10 (31%)
Hypoglycemia	0	0	0
Missing data	23 (35%)	13 (39%)	10 (31%)
Interval since last MI			
6 hours - 14 days	10 (42%)	6 (50%)	4 (33%)
> 45 days	2 (16%)	2 (17%)	2 (17%)
> 90 days	10 (42%)	4 (33%)	6 (50%)
Previous intervention			
None	52 (80%)	28 (85%)	24 (75%)
One	9 (14%)	2 (6%)	7 (22%)
Two	4 (6%)	3 (9%)	1 (3%)
Previous CABG			
None	61 (94%)	32 (97%)	29 (91%)
One	4 (6%)	1 (3%)	3 (3%)

this chapter. By keeping these two medication groups together, changes in prescription patterns can be readily identified.

Table 8 presents results of statistical comparison between the surgery groups (CABG vs. OPCAB).

Within the preoperative variables there were no significant findings meeting the criteria of p =.010. However, it was of clinical interest to find that there was a difference in history of chronic pain. The OPCAB subjects reported more chronic pain than the CABG subjects (p= .044). This finding was further explored to see if there was a relationship based on which surgeon performed OHS but there was no relationship (p= .312). Subject reports of chronic pain were elicited as part of the nursing interview during Medical Center admission and these subjects may or may not have had a diagnosis of chronic pain in their physician's history and physical report.

It is important to note the surgical groups did not differ based on gender, race, marital status; preoperative comorbidities; BMI, EF; NYHA class; preoperative medications; length of time since last MI (if they had had one) cardiac intervention or CABG; smoking or drinking history; or preoperative arrhythmias.

Age Groups

Descriptive data for preoperative variables of the age groups are presented in Table 9.

Table 8 presents results of statistical comparison between the age groups (67-74 vs. 75-86). During the preoperative period, there was one statistical comparison that reached statistical significance. The risk for transfusion was greater in the old group compared to the young-old group (p=.004). Findings which were of clinical interest

Table 8

Preoperative Variables: Significance Levels from Surgery, Age and Gender Group Comparisons

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Demographic Variables			
Age	.708	--	.903
Gender	.708	.903	--
Surgery	--	.584	.920
Marital status	.914	.447	.002**[c]
Race/ethnicity	.611	.592	.611
Functional and Comorbidity Variables			
ASA scores	.274	.924	.354
Cardiac RiskMaster score			
Death	.557	.049	.181
Near-miss	.353	.066	.044*[c]
Transfusion	.715	.004**[b]	.003**[c]
Stroke	.282	.030	.033*[c]
Drinking history	.611	.591	.080
EF%	.256	.034	.430*[c]
History of arrhythmias	.321	.267	.267
History of chronic pain	.044*[a]	.482	.255
Interval since last MI	.494	.501	.712
NYHA class	.256	.512	.774
Preexisting comorbidities			
COPD	.181	.181	.562
Hyperlipidemia	.174	.897	.034*[c]
HTN	.724	.060*[b]	.092
CRF	.746	.254	.238

Table 8 (Continued)

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Preexisting comorbidities			
CRI	.512	.512	.512
BPH	.114	.512	.125
Hypothroidism	.628	.372	.119
Arthritis	.195	.079	.530
Fibromyalgia	.492	.492	.508
Diabetes - insulin treatment	.515	.483	.168
Diabetes - oral agent treatment	.783	.523	.294
Cancer	.546	.297	.322
Depression	.611	.358	.611
PVD	.611	.590	.022*[c]
Pulmonary edema	none	none	none
Cerebral events	.460	.460	.460
Sudden death history	.746	.254	.254
UTI history	.238	.238	.238
Preoperative hours in CICU	.347	.530	.469
Previous CABG	.287	.318	.318
Previous cardiac cath interventions	.567	.736	.518
Smoking history	.542	.134	.088
Time since last contrast medium exposure	.650	.146	.650
Physiological Variables			
BP : outside 90-140 mm Hg systolic range	.264	.355	.478
BMI category	.131	.635	.695
EF category	.261	.256	.215

Table 8 (Continued)

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Physiological Variables			
Laboratory values			
Creatinine	.430	.545	.645
Glucose	.528	.236	.633
Hematocrit	.287	.215	.349
K+	.188	.628	.587
Provider Therapy Variables			
Medications			
Beta blockers	.105	.543	.033*[d]
ACE	.867	.725	.725
Lipid lowering agent (LLA)	.168	.379	.540
Calcium channel blocker (CCB)	.649	.934	.535
Analgesic	.168	.667	.485
H_2 blocker	.485	.168	.168
Diuretic	.663	.663	.029*[c]
Antibiotic	.746	.238	.746
Inhaler	.337	.119	.628
Vitamins	.943	.485	.221
Herbals	.125	.125	.512
Iron	.512	.512	.114
Antithrombotic	.261	.084	.102
Oral agent	.562	.602	.485
Insulin	.512	.488	.699
Nitrate	.718	.524	.890
Proton pump inhibitor	.351	.649	.091

Table 8 (Continued)

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Medications			
Inotrope	.387	.387	.034*[c]
Antiarrhythmic	.512	.573	.114
Hormone	.579	.939	.000**[c]
Alpha II blocker	.318	.317	.318
Thyroid	.387	.526	.005**[c]
SSRI	.485	.485	.168

Note. * - clinical significance p= .01 - .065. ** - statistical significance p= .01 or less
[a]O>C. [b]O>Y. [c]F>M. [d]M>F

Table 9

Preoperative Variables: Descriptive Data for Age Groups

Variables of Comparison	Total sample N=65	Ages 67-74	Ages 75-86
Preadmission Demographic Variables			
Surgery group	33/32	17/15	16/17
Gender			
Male	33 (51%)	16 (50%)	17 (52%)
Female	32 (49%)	16 (50%)	16 (48%)
Marital Status			
Single	3 (5%)	2 (6%)	1 (3%)
Married	39 (60%)	20 (63%)	19 (58%)
Divorced	4 (6%)	3 (9%)	1 (3%)
Widowed	19 (29%)	7 (22%)	12 (36%)
Separated	0	0	0
Race			
Caucasian	62 (95%)	30 (94%)	32 (97%)
African-American	2 (3%)	1 (3%)	1 (3%)
Hispanice	1 (2%)	1 (3%)	0
Functional and Comorbidity Variables			
Preoperative arrhythmias			
None	56 (86%)	31 (97%)	25 (76%)
Atrial fibrillation	6 (9%)	1 (3%)	5 (15%)
PVC's	2 (3%)	0	2 (6%)
Pacer	1 (2%)	0	1 (3%)
History of chronic pain			
None	58 (89%)	27 (85%)	31 (94%)
Arthritis	5 (8%)	3 (9%)	2 (6%)
Other	2 (3%)	2 (6%)	0

Table 9 (Continued)

Variables of Comparison	Total sample N=65	Ages 67-74	Ages 75-86
Riskmaster			
Near miss mean, range	3.07-54.99	3.86-35.14	3.07-54.99
Death mean, range	.88-28.55	.88-14.35	1.33-28.55
Stroke mean, range	.93-17.07	.93-11.65	1.30-17.07
Transfusion mean, range	.65-5.73	.65-5.73	1.33-5.73
Comorbidity			
COPD	12 (18%)	8 (25%)	4 (12%)
Hyperlipidemia	34 (52%)	17 (53%)	17 (52%)
HTN	40 (62%)	16 (50%)	24 (73%)
Chronic renal failure	2 (3%)	0	2 (6%)
Chronic renal insufficiency	3 (5%)	1 (3%)	2 (6%)
BPH	3 (5%)	1 (3%)	2 (6%)
Hypothyroidism	8 (12%)	3 (9%)	5 (15%)
Arthritis	8 (12%)	4 (13%)	4 (12%)
Fibromyalgia	1 (2%)	0	1 (3%)
Diabetic:			
Oral agent	11 (17%)	5 (16%)	6 (18%)
Insulin	5 (8%)	3 (9%)	2 (6%)
Cancer	8 (12%)	6 (16%)	2 (6%)
Depression	5 (8%)	3 (9%)	2 (6%)
PVD	6 (9%)	3 (9%)	3 (9%)
Pulmonary edema history	0	0	0
Cerebral events	5 (8%)	4 (13%)	1 (3%)
Sudden death history	2 (3%)	0	2 (6%)
UTI	2 (3%)	2 (6%)	0

Table 9 (Continued)

Variables of Comparison	Total sample N=65	Ages 67-74	Ages 75-86
Previous MI			
None	40 (62%)	18 (56%)	22 (67%)
One	21 (32%)	10 (31%)	11 (33%)
Two	4 (6%)	4 (13%)	0
Smoking status			
Never smoked	37 (57%)	14 (44%)	23 (70%)
Smoking now	7 (11%)	6 (16%)	1 (3%)
Smoking within the last 6 months	1 (2%)	1 (3%)	0
Quit over 6 months ago	20 (31%)	11 (34%)	9 (27%)
ETOH use			
No reported drinking	60 (92%)	29 (91%)	31 (94%)
0-2 drinks/day	4 (6%)	2 (6%)	2 (6%)
"heavy" > 5 years ago	1 (2%)	1 (3%)	0
Contrast medium exposure to OR time in days			
Mean (SE)	10.6 (3.6)	10.6 (3.6)	4.6 (2.1)
Median	1.0	2.0	1.0
Range	1-92	1-92	1-57
Physiological Variables			
Blood pressure category			
Normotensive	53 (82%)	26 (81%)	27 (82%)
Hypotensive	0	0	0
Hypertensive	11 (17%)	6 (19%)	5 (15%)
Missing data	1 (2%)	0	1 (3%)

Table 9 (Continued)

Variables of Comparison	Total sample N=65	Ages 67-74	Ages 75-86
Body mass index (BMI)			
19-24.9 ideal	23 (35%)	12 (38%)	11 (33%)
25-29.9 obese	22 (34%)	10 (31%)	12 (36%)
> 30.0 morbid obese	15 (23%)	9 (28%)	6 (18%)
Missing data	5 (8%)	1 (3%)	4 (13%)
Ejection fraction %			
20-29%	2 (3%)	1 (3%)	1 (3%)
30-39%	8 (12%)	5 (16%)	3 (9%)
40-49%	7 (11%)	6 (19%)	1 (3%)
50-59%	8 (12%)	4 (13%)	4 (12%)
60-69%	19 (29%)	8 (25%)	11 (33%)
70-79%	19 (29%)	8 (25%)	11 (33%)
80-89%	2 (3%)	0	2 (6%)
NYHA classification			
None/missing data	11 (17%)	3 (9%)	8 (24%)
I	31 (48%)	15 (47%)	16 (46%)
II	7 (11%)	3 (9%)	4 (12%)
III	7 (11%)	4 (13%)	3 (9%)
IV	9 (14%)	7 (22%)	2 (6%)
Preoperative hemoglobin			
Normal (13.5-17.7 g/dL)	27 (42%)	12 (38%)	15 (45%)
Below normal	32 (49%)	17 (53%)	15 (45%)
Above normal	0	0	0
Missing data	6 (9%)	3 (9%)	3 (9%)

Table 9 (Continued)

Variables of Comparison	Total sample N=65	Ages 67-74	Ages 75-86
Preoperative hematocrit			
Normal (40.0-53.0 g/dL)	20 (31%)	12 (38%)	8 (24%)
Below normal	30 (46%)	14 (44%)	16 (48%)
Above normal	0	0	0
Missing data	15 (23%)	6 (19%)	9 (27%)
Preoperative glucose			
Normal (80-119 mg/dL)	24 (37%)	12 (38%)	12 (38%)
Hyperglycemia	16 (25%)	9 (28%)	7 (21%)
Hypoglycemia	0	0	0
Missing data	23 (35%)	9 (28%)	14 (42%)
Interval since last MI	N = 25	N = 14	N = 11
6 hours - 14 days	10 (40%)	6 (43%)	4 (36%)
> 45 days	4 (16%)	3 (21%)	1 (9%)
> 90 days	10 (40%)	4 (29%)	6 (55%)
Missing data	1 (4%)	1 (7%)	0
Previous intervention			
None	52 (80%)	25 (81%)	27 (82%)
One	9 (14%)	5 (16%)	4 (12%)
Two	4 (6%)	2 (6%)	2 (6%)
Previous CABG			
None	61 (94%)	31 (97%)	30 (91%)
One	4 (6%)	1 (3%)	3 (9%)

included Cardiac RiskMaster scores were higher for the old group compared to the young-old group: death (p=.049), near miss p= .070) and stroke (p= .030). In addition, the old subjects more often had hypertension (HTN) (p= .060) compared to the young-old. Among the preoperative variable categories, age groups did not vary based on surgery or gender groups, any demographic variables, and comorbidities other than HTN, ASA risk, preoperative comorbidities, or preoperative medications.

Gender Groups

Descriptive data for preoperative variables of the gender groups are presented in Table 10.

Table 8 presents results of statistical comparison between the gender groups (male vs. female). Statistically significant findings included marital status was different based on the finding that more females were widowed (female>male, p= .002) and Cardiac Riskmaster transfusion scores were higher for females (p= .003).

Gender groups had preoperative variables which were of clinical interest as well: CardiacRisk master scores for near-miss female>male (p= .040) and stroke female> male (p= .030); preoperative hyperlipidemia female>male (p= .034); preoperative peripheral vascular disease (PVD) female>male (p= .022); and preoperative use of beta blockers males>females (p= .033), diuretics females>males (p= .029) and inotropes females > males (p= .037). It was interesting to note that females did not have a statistically or clinically significantly higher risk of death, NYHA class or ejection fraction.

Intraoperative Period

Surgery Groups

Descriptive data for intraoperative variables of the surgery groups are presented

in Table 11.

Within the OR subjects in surgical groups varied statistically based on body temperature (OPCAB > CABG, p= .000) and number of grafts (CABG>OPCAB, p= .001). Urine output was also statistically different CABG > OPCAB (p= .000). This is not surprising given the use of Mannitol (a diuretic) IV in the CABG population at this Medical Center. Anesthesia time (p= .004) and surgical time (p= .000) were also statistically greater in the CABG sample. This finding is consistent with time required to cross-clamp and go on and come off cardio-pulmonary bypass. There were no other findings of statistical or clinical interest.

Table 12 presents results of statistical comparison between the surgery groups (CABG vs. OPCAB).

Age Groups

Descriptive data for intraoperative variables of the age groups are presented in Table 13.

Table 12 presents results of statistical comparison between the age groups. Within the age groups subjects differed statistically because the young-old received more crystalloid than old subjects (p= .005).

Gender Groups

Descriptive data for intraoperative variables of the gender groups are presented in Table 14.

Table 12 presents results of statistical comparison between the gender groups. There were statistically or clinically significant gender differences during the intraoperative time timeframe.

Table 10

Preoperative Variables: Descriptive Data for Gender Groups

Variables of Comparison	Total sample N=65	Male	Female
Preadmission Demographic Variables			
Surgery group (CABG/OPCAB)	33/32	16/17	17/15
Gender			
Male	33 (51%)	33 (100%)	0
Female	32 (49%)	0	32 (100%)
Marital Status			
Single	3 (5%)	1 (3%)	2 (6%)
Married	39 (60%)	27 (82%)	12 (38%)
Divorced	4 (6%)	2 (6%)	2 (6%)
Widowed	19 (29%)	3 (9%)	16 (50%)
Separated	0	0	0
Race			
Caucasian	62 (95%)	31 (94%)	31 (97%)
African-American	2 (3%)	1 (3%)	1 (3%)
Hispanice	1 (2%)	1 (3%)	0
Functional and Comorbidity Variables			
Preoperative arrhythmias			
None	56 (86%)	30 (91%)	26 (81%)
Atrial fibrillation	6 (9%)	2 (6%)	4 (13%)
PVC's	2 (3%)	1 (3%)	1 (3%)
Pacer	1 (2%)	0	1 (3%)
History of chronic pain			
None	58 (89%)	31 (94%)	27 (84%)
Arthritis	5 (8%)	1 (3%)	4 (13%)
Other	2 (3%)	1 (3%)	1 (3%)

Table 10 (Continued)

Variables of Comparison	Total sample N=65	Male	Female
Riskmaster			
Near miss mean, range	3.07-54.99	3.07-52.88	5.04-54.99
Death mean, range	.88-28.55	.88-22.49	1.30-28.55
Stroke mean, range	.93-17.07	.93-13.22	1.28-17.07
Transfusion mean, range	.65-5.73	.65-5.73	1.23-5.58
Comorbidity			
COPD	12 (18%)	7 (21%)	5 (16%)
Hyperlipidemia	34 (52%)	13 (39%)	21 (66%)
HTN	26 (40%)	17 (52%)	9 (28%)
Chronic renal failure	2 (3%)	0	2 (6%)
Chronic renal insufficiency	3 (5%)	2 (6%)	1 (3%)
BPH	3 (5%)	3 (9%)	0
Hypothyroidism	8 (12%)	2 (6%)	6 (19%)
Arthritis	9 (14%)	3 (9%)	6 (19%)
Fibromyalgia	1 (2%)	1 (3%)	0
Diabetic:			
Oral agent	11 (17%)	4 (11%)	7 (22%)
Insulin	5 (8%)	1 (3%)	4 (13%)
Cancer	7 (11%)	4 (12%)	3 (9%)
Depression	5 (8%)	3 (9%)	2 (6%)
PVD	7 (11%)	1 (3%)	6 (19%)
Pulmonary edema history	0	0	0
Cerebral events	5 (8%)	1 (3%)	4 (13%)
Sudden death history	2 (3%)	2 (6%)	0
UTI	2 (3%)	0	2 (6%)

Table 10 (Continued)

Variables of Comparison	Total sample N=65	Male	Female
Previous MI			
None	40 (62%)	18 (55%)	22 (69%)
One	21 (32%)	12 (36%)	9 (28%)
Two	4 (6%)	3 (9%)	1 (3%)
Smoking status			
Never smoked	37 (57%)	17 (52%)	20 (63%)
Smoking now	7 (11%)	2 (6%)	5 (16%)
Smoking within the last 6 months	1 (2%)	0	1 (3%)
Quit over 6 months ago	20 (31%)	14 (42%)	6 (19%)
ETOH use			
No reported drinking	62 (95%)	31 (89%)	31 (97%)
0-2 drinks/day	4 (6%)	4 (12%)	0
"heavy" > 5 years ago	1 (2%)	0	1 (3%)
Contrast medium exposure to OR time in days			
Mean (SE)	7.6 (2.9)	6.6 (2.4)	8.5 (3.4)
Median	1.0	1.0	2.0
Range	1-92	1-57	1-92
Physiological Variables			
Blood pressure category			
Normotensive	53 (82%)	29 (88%)	24 (75%)
Hypotensive	0	0	0
Hypertensive	11 (17%)	4 (12%)	7 (22%)
Missing data	1 (2%)	0	1 (3%)

Table 10 (Continued)

Variables of Comparison	Total sample N=65	Male	Female
Body mass index (BMI)			
19-24.9 ideal	23 (35%)	9 (27%)	14 (44%)
25-29.9 obese	22 (34%)	11 (33%)	11 (34%)
> 30.0 morbid obese	16 (25%)	9 (27%)	7 (22%)
Missing data	5 (8%)	4 (11%)	1 (3%)
Ejection fraction %			
20-29%	2 (3%)	2 (6%)	0
30-39%	8 (12%)	2 (6%)	6 (18%)
40-49%	7 (11%)	7 (21%)	0
50-59%	8 (12%)	3 (9%)	5 (15%)
60-69%	19 (29%)	12 (36%)	7 (22%)
70-79%	19 (29%)	7 (21%)	12 (38%)
80-89%	2 (3%)	0	2 (6%)
NYHA classification			
None/missing data	11 (17%)	9 (27%)	9 (27%)
I	32 (49%)	15 (46%)	17 (52%)
II	7 (11%)	5 (14%)	2 (6%)
III	7 (11%)	3 (9%)	4 (12%)
IV	2 (3%)	1 (3%)	1 (3%)
Preoperative hemoglobin			
Normal (13.5-17.7 g/dL)	27 (42%)	19 (58%)	8 (25%)
Below normal	32 (49%)	12 (36%)	20 (63%)
Above normal	0	0	0
Missing data	6 (9%)	2 (6%)	4 (13%)

Table 10 (Continued)

Variables of Comparison	Total sample N=65	Male	Female
Preoperative hematocrit			
Normal (40.0-53.0 g/dL)	20 (31%)	15 (45%)	5 (16%)
Below normal	30 (46%)	11 (33%)	19 (60%)
Above normal	0	0	0
Missing data	15 (23%)	7 (21%)	8 (25%)
Preoperative glucose			
Normal (80-119 mg/dL)	24 (37%)	14 (42%)	10 (31%)
Hyperglycemia	18 (28%)	10 (30%)	8 (25%)
Hypoglycemia	0	0	0
Missing data	23 (35%)	9 (27%)	14 (44%)
Interval since last MI			
6 hours - 14 days	10 (15%)	7 (47%)	3 (30%)
> 45 days	4 (6%)	2 (13%)	2 (20%)
> 90 days	10 (15%)	5 (33%)	5 (50%)
Missing data	1 (2%)	1 (7%)	0
Previous intervention			
None	52 (80%)	27 (82%)	25 (78%)
One	9 (14%)	5 (15%)	4 (13%)
Two	4 (6%)	1 (3%)	3 (9%)
Previous CABG			
None	61 (94%)	30 (91%)	31 (97%)
One	4 (6%)	3 (9%)	1 (3%)

Table 11

Intraoperative Variables: Descriptive Data for Surgery Groups

Variables of Comparison	Total sample N=65	CABG N=33	OPCAB N=32
Intraoperative (OR) Variables			
Arrhythmias			
None	64 (98%)	32 (97%)	32 (100%)
Atrial fibrillation	1 (2%)	1 (3%)	0
Blood pressures			
Normal (90-140 mm Hg systolic	35 (54%)	17 (52%)	18 (56%)
>140 systolic	8 (12%)	2 (6%)	6 (19%)
< 90	13 (20%)	7 (21%)	6 (19%)
Both >140 and < 90	9 (14%)	7 (21%)	2 (6%)
Codes	0	0	0
Output of Urine in cc's			
Mean (SE)	927 (71)	1252 (92)	591 (69)
Median	850	1150	537
Range	25-2875	550-2875	25-2000
Temperature			
Normal	37 (57%)	11 (33%)	26 (81%)
< 35 degrees	20 (31%)	20 (61%)	0
Missing data	8 (12%)	2 (6%)	6 (19%)
Provider Therapy Variables			
Bypass grafts done			
One	11 (17%)	0	11 (34%)
Two	16 (25%)	6 (18%)	10 (31%)
Three	26 (40%)	17 (52%)	9 (28%)
Four	12 (18%)	10 (30%)	2 (6%)

Table 11 (Continued)

Variables of Comparison	Total sample N=65	CABG N=33	OPCAB N=32
Bypass grafts done			
Mean hours	2.6	3.12	2.06
Median	3.0	3.0	2.0
Range	1-4	2-4	1-4
Cardiopulmonary bypass time in minutes			
Mean (SE)	74.7 (3.8)	74.7 (3.8)	NA
Median	71.0	71.0	
Range	42-118	42-118	
Cross-clamp time in minutes			
Median (SE)	47.3 (2.4)	47.3 (2.4)	NA
Median	47.0	47.0	
Range	22-91	22-91	
Colloid use by type			
Albumin 25%	18 (28%)	15 (45%)	3 (9%)
Albumin 5%	4 (6%)	4 (12%)	0
FFP	2 (3%)	1 (3%)	1 (3%)
Cryoprecipitate	1 (2%)	1 (3%)	0
None	41 (63%)	12 (36%)	29 (91%)
Crystalloid use in cc's			
Mean cc (SE)	2672 (148)	2902 (186)	2429 (228)
Median cc	2600	3000	2500
Range	500-5700	800-5000	500-5700
IABP use in OR			
Yes	11 (17%)	7 (21%)	4 (13%)
No	54 (83%)	26 (79%)	28 (87%)

Table 11 (Continued)

Variables of Comparison	Total sample N=65	CABG N=33	OPCAB N=32
OR RBC use			
None	47 (72%)	19 (58%)	28 (88%)
One unit	2 (3%)	1 (3%)	1 (6%)
Two units	10 (15%)	9 (27%)	1 (3%)
Three units	2 (3%)	2 (6%)	0
Four units	2 (3%)	2 (6%)	0
Five units	1 (2%)	0	1 (3%)
Two	4 (6%)	1 (3%)	3 (9%)
Time and Functional Variables			
Anesthesia time in hours			
Mean	6.75 (8.7)	7.16 (11.5)	6.33 (11.6)
Median	6.63	7.16	6.35
Range	3.7-9.0	5.1-9.0	3.7-8.3
Mortality during OR	0	0	0
OR time in hours			
Mean (SE)	2.8 (4.6)	3.1 (5.2)	2.5 (6.0)
Median	2.8	3.1	2.6
Range	1.3-4.1	2.0-4.1	1.3-3.4
Survival to discharge from OR			
Yes	65 (100%)	33 (100%)	32 (100%)
No	0	0	0

Table 12

Intraoperative Variables: Significance Levels from Surgery, Age, and Gender Comparisons

Variables	Surgery Groups	Age Groups	Gender Groups
Physiological Variables			
Arrhythmias	.508	.492	.371
BP's: outside 90-140 mm Hg systolic range	.182	.378	.111
Code	none		
Output			
Urine	.000**[a]	.889	.958
Temperature	.182	.695	.807
Provider Therapy Variables			
Cardiopulmonary bypass time	NA	.331	.861
Colloid replacement	.758	.540	.540
Cross-clamp time	N/A	.838	.488
Crystalloid replacement in OR	.111	.005**[b]	.509
Intraaortic balloon pump use	.443	.783	.783
Number of grafts	.001**[a]	.653	.292
Transfusions			
RBC	.174	.672	.672
Time and Functional Variables			
Anesthesia time	.004**[a]	.097	.672
Surgical time	.000**[a]	.128	.865
Survival to discharge from the OR	all survived		

Note. * - clinical significance p= .01 - .065. ** - statistical significance p= .01 or less
[a]C>O. [b]Y>O

Table 13

Intraoperative Variables: Descriptive Data for Age Groups

Variables of Comparison	Total sample N = 65	Ages 67-74	Ages 75-86
Physiological Variables			
Arrhythmias			
None	64 (98%)	32 (100%)	32 (97%)
Atrial fibrillation	1 (2%)	0	1 (3%)
Blood pressures			
Normal (90-140 mm Hg systolic	35 (54%)	18 (56%)	17 (52%)
>140 systolic	8 (12%)	2 (6%)	6 (18%)
< 90	13 (20%)	6 (19%)	7 (21%)
Both >140 and < 90	9 (14%)	6 (19%)	3 (9%)
Codes	0	0	0
Output of Urine in cc's			
Mean (SE)	951 (78)	1120 (112)	772 (853)
Median	815	1090	700
Range	25-2875	160-2100	25-2875
Temperature			
Normal	37 (57%)	17 (53%)	20 (61%)
< 35 degrees	20 (31%)	10 (31%)	10 (30%)
Missing data	8 (12%)	5 (16%)	3 (9%)

Table 13 (Continued)

Variables of Comparison	Total sample N = 65	Ages 67-74	Ages 75-86
Provider Therapy Variables			
Bypass grafts done			
One	11 (17%)	4 (13%)	7 (21%)
Two	16 (25%)	8 (25%)	8 (24%)
Three	26 (40%)	15 (47%)	11 (33%)
Four	12 (18%)	5 (16%)	7 (21%)
Mean (SE)	2.6	2.7	2.5
Median	3.0	3.0	3.0
Range	1-4	1-4	1-4
Cardiopulmonary bypass time in minutes			
Mean (SE)	34.2 (4.9)	40.0 (7.2)	30.2 (6.9)
Median	0	51.5	0
Range	0-118	0-109	0-118
Cross-clamp time in minutes			
Mean (SE)	22.8 (3.4)	22.2 (5.4)	23.4 (4.4)
Median	23.0	23.0	27.0
Range	0-91	0-64	0-91
None	19 (29%)	15 (47%)	4 (12%)

Table 13 (Continued)

Variables of Comparison	Total sample N = 65	Ages 67-74	Ages 75-86
Colloid use by type			
Albumin 25%	18 (28%)	8 (25%)	10 (30%)
Albumin 5%	4 (6%)	3 (9%)	1 (3%)
FFP	3 (5%)	0	3 (9%)
Cryoprecipitate	1 (2%)	1 (3%)	0
None	41 (63%)	20 (63%)	21 (64%)
Crystalloid use in cc's			
Mean cc (SE)	2672 (148)	3096 (204)	2274 (191)
Median cc	2600	3000	2300
Range	500-5700	1000-5700	500-5000
IABP use in OR			
Yes	11 (17%)	5 (16%)	6 (18%)
No	54 (83%)	27 (84%)	27 (82%)
OR RBC use			
None	47 (72%)	25 (78%)	22 (67%)
One unit	1 (2%)	1 (3%)	0
Two units	10 (15%)	3 (9%)	7 (21%)
Three units	2 (3%)	2 (6%)	0
Four units	2 (3%)	1 (3%)	1 (3%)
Five units	1 (2%)	0	1 (3%)
Two	4 (6%)	1 (3%)	3 (9%)

Table 13 (Continued)

Variables of Comparison	Total sample N = 65	Ages 67-74	Ages 75-86
Time and Functional Variables			
Anesthesia time in hours			
Mean	6.75 (8.7)	6.98 (11.5)	6.50 (12.7)
Median	6.7	6.7	6.5
Range	3.7-9.0	4.7-8.9	3.7-9.0
Mortality during OR	0	0	0
OR time in hours			
Mean (SE)	2.8 (4.6)	2.9 (6.4)	2.7 (6.4)
Median	2.8	3.0	2.7
Range	1.3-4.1	1.6-4.1	1.3-3.9
ASA scores			
I	0	0	0
II	2 (3%)	1 (3%)	1 (3%)
III	11 (17%)	6 (19%)	5 (15%)
IV	48 (74%)	23 (72%)	25 (76%)
Missing data	4 (6%)	2 (6%)	2 (6%)
Survival to discharge from OR	65 (100%)	32 (100%)	33 (100%)

Table 14

Intraoperative Variables: Descriptive Data for Gender Groups

Variables of Comparison	Total sample N=65	Male	Female
Intraoperative (OR) Variables			
Arrhythmias			
None	64 (98%)	33 (100%)	31 (97%)
Atrial fibrillation	1 (2%)	0	1 (3%)
Blood pressures			
Normal (90-140 mm Hg systolic	35 (54%)	20 (61%)	15 (47%)
>140 systolic	8 (12%)	1 (3%)	7 (22%)
< 90	13 (20%)	8 (24%)	5 (16%)
Both >140 and < 90	10 (14%)	4 (12%)	6 (16%)
Codes	0	0	0
Output of Urine in cc's			
Mean (SE)	951 (76)	1070 (112)	832 (85)
Median	815	885	773
Range	25-2875	125-2875	25-2250
Temperature			
Normal	37 (57%)	20 (61%)	17 (53%)
< 35 degrees	20 (31%)	9 (27%)	11 (34%)
Missing data	8 (12%)	4 (12%)	4 (13%)
Provider Therapy Variables			
Bypass grafts done			
One	13 (20%)	6 (17%)	7 (22%)
Two	16 (25%)	8 (23%)	8 (25%)
Three	26 (40%)	14 (40%)	12 (38%)
Four	13 (20%)	7 (20%)	6 (16%)

Table 14 (Continued)

Variables of Comparison	Total sample N=65	Male	Female
Bypass grafts done			
Mean (SE)	2.6	2.7	2.5
Median	3.0	3.0	3.0
Range	1-4	1-4	1-4
Cardiopulmonary bypass time in minutes			
Mean (SE)	35.2 (5.0)	31.6 (7.0)	38.6 (7.2)
Median	0	0	46.5
Range	0-105	0-105	0-118
Cross-clamp time in minutes			
Mean (SE)	22.8 (3.4)	22.2 (5.4)	23.4 (4.4)
Median	23.5	23.0	24.0
Range	0-91	0-91	0-65
Colloid use by type			
Albumin 25%	18 (28%)	9 (27%)	9 (28%)
Albumin 5%	4 (6%)	1 (3%)	3 (9%)
FFP	4 (6%)	3 (9%)	1 (3%)
Cryoprecipitate	1 (2%)	0	1 (3%)
None	41 (63%)	22 (67%)	19 (59%)
Crystalloid use in cc's			
Mean cc (SE)	2673 (150)	2768 (208)	2571 (212)
Median cc	2600	2900	2500
Range	500-5700	650-5000	500-5700
IABP use in OR			
Yes	11 (17%)	6 (18%)	5 (16%)
No	54 (83%)	27 (82%)	27 (84%)

Table 14 (Continued)

Variables of Comparison	Total sample N=65	Male	Female
OR RBC use			
None	49 (75%)	29 (83%)	20 (63%)
One unit	3 (5%)	0	3 (9%)
Two units	10 (15%)	4 (11%)	6 (19%)
Three units	2 (3%)	1 (3%)	1 (3%)
Four units	2 (3%)	0	2 (6%)
Five units	1 (2%)	1 (3%)	0
Time and Functional Variables			
Anesthesia time in hours			
Mean	6.9 (8.7)	6.9 (9.7)	6.6 (14.5)
Median	6.6	6.6	6.8
Range	3.7-9.0	5.1-8.9	3.7-9.0
Mortality during OR	0	0	0
OR time in hours			
Mean (SE)	2.8 (6.7)	2.8 (5.5)	2.8 (7.8)
Median	2.8	2.8	2.8
Range	1.3-4.1	1.9-3.8	1.3-4.1
ASA scores			
I	0	0	0
II	2 (3%)	2 (6%)	0
III	11 (17%)	5 (15%)	6 (19%)
IV	48 (74%)	24 (73%)	24 (75%)
Missing data	4 (6%)	2 (6%)	2 (6%)
Survival to discharge from OR	65 (100%)	33 (100%)	32 (100%)

CICU Period

Surgical Groups

Descriptive data for CICU variables of the surgery groups are presented in Table 15.

Table 16 presents results of statistical comparison between the surgery groups.

During the CICU Period, first GCS reached statistical significance (OPCAB > CABG, p = .001) and Time until the bulb (leg drain from venous harvest site) was discontinued was greater in the OPCAB subjects (p= .008). There was several finding of significance to nursing: a) the total blood output (Blake, bulb and chest tube combined) was clinical significant (p= .018), b) the OPCAB subjects' extubated after surgery sooner than the CABG subject (p= .060), CICU urine output remained higher in the CABG group (p= .053), RBC transfusions were greater (those getting more than 2 units) in the CABG group than the OPCAB group (p= .027), and 1:1 nursing care time was longer for the CABG patients (p= .061). It was of particular interest to note that surgery groups did not vary based on vasoactives used, the length of time hemodynamic lines were present in subjects and pain medications administered.

Age Groups

Descriptive data for CICU variables of the age groups are presented in Table 17. Table 16 presents results of statistical comparison between the age groups.

There were no statistically significant findings based on the age groups. There were several findings which were of clinical interest: the old took longer to be extubated than the young-old (p= .057) and the hours the old had pulmonary artery (PA) lines (p= .034), arterial lines (p= .048) and catheters (p= .060) were longer for the old than the

Table 15

CICU Variables: Descriptive Data for Surgery Groups

Variables of Comparison	All	CABG	OPCAB
Physiological Variables			
Arrhythmias			
None	44 (68%)	20 (61%)	24 (75%)
Atrial fibrillation/flutter	11 (17%)	7 (21%)	4 (13%)
Ventricular tachycardia	2 (3%)	1 (3%)	1 (3%)
Pacemaker use (temporary)	5 (8%)	3 (9%)	2 (6%)
Previous pacemaker	2 (3%)	1 (3%)	1 (3%)
PVC's requiring treatment	1 (2%)	1 (3%)	0
Arrhythmia duration (hours)			
< 1 minute	1 (5%)	1 (8%)	0
0 - 24 hours	10 (53%)	6 (46%)	4 (50%)
24 - 48 hours	2 (11%)	1 (8%)	0
48 – 72 hours	3 (16%)	1 (8%)	2 (25%)
72 – 96 hours	1 (5%)	1 (8%)	0
96-120 hours	1 (5%)	0	1 (12%)
120-144 hours	0	0	0
144-168 hours	0	0	0
168- 192 hours	0	0	0
192-216 hours	1 (5%)	1 (8%)	0
Missing data	3 (16%)	2 (15%)	1 (12%)
Arterial blood gases – pH (normal 7.35-7.45)			
Normal	62 (95%)	32 (97%)	30 (94%)
< 7.2 x 1	1 (2%)	0	1 (3%)
< 7.2 x 2	1 (2%)	0	1 (3%)
> 7.55 x 2	1 (2%)	1 (3%)	0

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Arterial blood gases – CO_2 (normal 35-45)			
Normal	63 (97%)	33 (100%)	30 (94%)
< 35 x 1	1 (2%)	0	1 (3%)
> 60 x 1	1 (2%)	0	1 (3%)
Arterial blood gases – O_2 (normal 80-100)			
Normal	64 (98%)	33 (100%)	31 (97%)
< 80 x 2	1 (2%)	0	1 (3%)
Blood glucose values requiring insulin drip use			
Yes	30 (46%)	18 (55%)	12 (38%)
No	35 (54%)	15 (45%)	20 (62%)
Blood pressure			
Normal (90-140 mm Hg systolic)	29 (45%)	16 (48%)	13 (40%)
> 140 mm Hg	9 (14%)	4 (12%)	5 (16%)
< 90	26 (40%)	12 (36%)	14 (44%)
Both > 140 and < 90	1 (2%)	1 (3%)	0
Bowel function: Hours to 1st bowel sounds			
0 - 24	51 (78%)	26 (79%)	25 (78%)
24 - 48	8 (12%)	5 (15%)	3 (9%)
Missing data	6 (9%)	2 (6%)	4 (13%)
Bowel function: Days until recorded stool			
POD 1	6 (9%)	4 (12%)	2 (6%)
POD 2	10 (15%)	1 (3%)	9 (28%)
POD 3	13 (20%)	11 (33%)	2 (6%)

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Bowel function: Days until recorded stool			
POD 4	12 (18%)	7 (21%)	5 (16%)
POD 5	7 (11%)	4 (12%)	3 (9%)
POD 6	2 (3%)	1 (3%)	1 (3%)
POD 7	2 (3%)	1 (3%)	1 (3%)
POD 8	0	0	0
POD 9	1 (2%)	0	1 (3%)
Missing data	12 (18%)	4 (12%)	8 (25%)
CLOS preoperative			
None	50 (77%)	23 (70%)	27 (84%)
0 - 24	8 (12%)	7 (21%)	1 (3%)
25 - 48	7 (11%)	3 (9%)	4 (12%)
CLOS postoperative			
0 - 24	12 (18%)	5 (15%)	7 (22%)
24 - 48	30 (46%)	16 (48%)	14 (44%)
48 - 72	8 (12%)	4 (12%)	4 (12%)
72 - 96	8 (12%)	3 (9%)	5 (16%)
96 - 120	4 (6%)	2 (6%)	2 (6%)
120 - 144	1 (2%)	1 (3%)	0
144 - 168	1 (2%)	1 (3%)	0
168 - 192	1 (2%)	1 (3%)	0
Code in CICU			
None	63 98%)	32 (97%)	31 (97%)
One	2 (3%)	1 (3%)	1 (3%)
Code status in CICU			
Full code	65 (100%)	33 (100%)	32 (100%)

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Delirium behavior in CICU			
Yes	11 (17%)	7 (21%)	4 (12%)
No	54 (83%)	26 (79%)	28 (88%)
Calcium in CICU			
Normal (9.3 – 10.9 mg/dL)	5 (8%)	33 (100%)	25 (78%)
< 7.0	1 (2%)	0	1 (3%)
Missing data	6 (9%)	0	6 (19%)
Creatinine in CICU			
Normal (0.6 – 1.3 mg/dL)	58 (89%)	29 (88%)	29 (91%)
> 2.0 x 1	4 (6%)	2 (6%)	2 (6%)
> 2.0 x 2	1 (2%)	0	1 (3%)
> 2 x 4	1 (2%)	1 (3%)	0
> 2 x 13	1 (2%)	1 (3%)	0
Hematocrit in CICU			
Normal (40.0 – 53.0 g/dL)	47 (72%)	20 (61%)	27 (84%)
< 25 x 1	12 (18%)	8 (24%)	4 (12%)
< 25 x 2	1 (2%)	1 (3%)	0
< 25 x 3	4 (6%)	3 (9%)	1 (3%)
< 25 < 4	1 (2%)	1 (3%)	0
Magnesium in CICU			
Normal (1.7 – 2.5 mg/dL)	49 (75%)	31 (94%)	18 (56%)
< 1.6	8 (12%)	2 (6%)	6 (19%)
< 16.2 x 2	2 (3%)	0	2 (6%)
Missing data	6 (9%)	0	6 (19%)

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Potassium in CICU			
Normal (3.7 – 5.5 mMol/L)	58 (89%)	27 (82%)	31 (97%)
< 3.0	2 (3%)	2 (6%)	0
> 5.5	2 (3%)	1 (3%)	1 (3%)
< 3.0 and > 5.5	3 (5%)	3 (9%)	0
Output in CICU in cc's:			
Total blood mean (SE)	952 (592)	1120 (112)	772 (85.3)
Total blood median	815	1090	700
Total blood range	122-2762	275-2762	122-2520
Total urine mean (SE)	5125 (496)	6067 (795)	4154 (547)
Total urine median	3885	4444	3595
Total urine range	25-19252	11-19252	25-16738
PA catheter values measuring left ventricular function			
Normal CI	35 (54%)	16 (48%)	19 (59%)
CI < 2.0 liters/minute x 1	12 (18%)	8 (24%)	4 (12%)
CI < 2.0 liters/minute x 2	5 (7%)	3 (9%)	2 (6%)
CI < 2.0 liters/minute x 3	5 (7%)	3 (9%)	2 (6%)
CI < 2.0 liters/minute x 4	3 (5%)	2 (6%)	1 (3%)
CI < 2.0 liters/minute x 5	2 (3%)	1 (3%)	1 (3%)
No PA line	3 (5%	0	3 (9%)
Normal PCWP	35 (54%)	18 (55%)	17 (53%)
PCWP > 18 mm Hg x 1	10 (15%)	5 (15%)	5 (16%)
PCWP > 18 mm Hg x 2	4 (6%)	1 (3%)	3 (9%)
PCWP > 18 mm Hg x 3	1 (2%)	1 (3%)	0
PCWP > 18 mm Hg x 4	3 (5%)	2 (6%)	1 (3%)

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
PA catheter values measuring left ventricular function			
PCWP > 18 mm Hg x 5	4 (6%)	3 (9%)	1 (3%)
PCWP > 18 mm Hg x 6	3 (5%)	3 (9%)	1 (3%)
PCWP > 18 mm Hg x 7	4 (6%)	0	4 (12%)
No PA line	3 (5%)	0	3 (9%)
Temperature in CICU			
Normal (35.0 – 37.0 C)	64 (98%)	33 (100%)	31 (97%)
>38.5	1 (2%)	0	1 (3%)
Provider Therapy Variables			
Colloid use in CICU			
None	31 (48%)	13 (39%)	18 (56%)
Plasmanate	1 (2%)	1 (3%)	0
Hetastarch	25 (38%)	12 (36%)	13 (41%)
FFP	1 (2%)	1 (3%)	0
Albumin	7 (11%)	6 (18%)	1 (3%)
Colloid use in OR and CICU (Total) in cc's			
Mean (SE)	1567 (163)	1810 (204)	1262 (183)
Median	1501	1950	1375
Range	750-2350	1200-2350	750-1550
Colloid total for OR and CICU			
Mean (SE)	1566 (163)	1810 (204)	1263 (183)
Median	1501	1950	1375
Range	750-2350	1200-2350	750-1550

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Consultants in CICU			
None	63 (97%)	32 (97%)	32 (97%)
Pulmonologist	1 (2%)	0	1 (3%)
Nephrologist	1 (2%)	1 (3%)	0
Crystalloid use in CICU in cc's			
None	25 (38%)	15 (45%)	10 (31%)
Mean (SE)	1051 (224)	913 (210)	1193 (244)
Median	700	250	825
Range	0-5000	0-4600	0-5000
Crystalloid total in OR and CICU			
Mean (SE)	3740 (300)	3815 (300)	3660 (338)
Median	3450	3450	3400
Range	88-8100	800-8100	800-8000
IABP use – hours until discontinued			
None	52 (80%)	25 (76%)	27 (84%)
0 - 24	3 (23%)	2 (6%)	1 (3%)
24 - 48	5 (38%)	4 (4%)	1 (3%)
48 - 72	5 (38%)	2 (6%)	3 (9%)
Medications – vasoactives use in CICU			
Nitroglycerin (NTG)-None	3 (5%)	0	3 (9%)
Epinephrine (Epi)-None	46 (71%)	24 (73%)	22 (69%)
Dopamine-None	32 (49%)	14 (42%)	18 (56%)
Nipride-None	49 (75%)	27 (82%)	22 (69%)
Neosynephrine (Neo)-None	57 (88%)	29 (88%)	28 (88%)
Dobutamine-None	62 (95%)	30 (91%)	32 (100%)

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Mobility – Hours until up to a chair			
0 - 24	49 (75%)	24 (73%)	25 (78%)
24 - 48	11 (17%)	5 (15%)	6 (19%)
48 - 72	1 (2%)	0	1 (3%)
72 - 96	1 (2%)	1 (3%)	0
96 - 120	1 (2%)	1 (3%)	0
120 - 144	2 (3%)	2 (6%)	0
Missing data	1 (2%)	1 (3%)	0
Pain medications - Morphine sulfate equivalencies			
DOS - N, mean (SD)	65, 14.7 (11.7)	33, 12.4 (7.2)	32, 17.2 (14.7)
POD 1 - N, mean (SD)	63, 19.1 (13.6)	32, 8.8 (12.9)	31, 19.3 (14.6)
POD 2 - N, mean (SD)	53, 15.5 (14.1)	25, 17.8 (14.1)	28, 14.1 (14.2)
POD 3 - N, mean (SD)	47, 14.8 (15.7)	22, 14.1 (13.0)	25, 15.4 (18.0)
POD 4 - N, mean (SD)	37, 14.6 (11.4)	19, 14.6 (11.6)	18, 14.4 (18.0)
POD 5 - N, mean (SD)	20, 18.9 (13.5)	10, 20.7 (15.4)	10, 17.0 (11.8)
POD 6 - N, mean (SD)	12, 14.9 (12.4)	7, 16.4 (12.4)	5, 13.0 (13.5)
POD 7 - N, mean (SD)	8, 23.1 (10.8)	4, 19.9 (8.5)	4, 26.2 (13.1)
POD 8 - N, mean (SD)	5, 20.0 (10.6)	3, 23.3 (12.6)	2, 15.0 (7.1)
POD 9 - N, mean (SD)	4, 25.0 (13.6)	3, 26.6 (16.1)	1, 20.0 (NA)

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Transfusions in CICU			
RBC None	31 (48%)	13 (39%)	18 (56%)
RBC 1 unit	13 (20%)	6 (19%)	7 (22%)
RBC 2 units	12 (18%)	6 (19%)	6 (19%)
RBC 3 units	1 (2%)	1 (3%)	0
RBC 4 units	4 (6%)	4 (12%)	0
RBC 5 units	2 (3%)	2 (6%)	0
RBC 6 units	1 (2%)	1 (3%)	0
RBC 7 units	0	0	0
RBC 8 units	0	0	0
RBC 9 units	1 (2%)	0	1 (3%)
FFP None	42 (65%)	30 (91%)	32 (100%)
FFP 2 pack	2 (3%)	2 (6%)	0
FFP 4 pack	1 (2%)	1 (3%)	0
Platelets None	62 (95%)	30 (91%)	3 (100%)
Platelets 10 pack x 2	2 (3%)	2 (6%)	0
Platelets 10 pack x 4	1 (2%)	1 (3%)	0
Time and Functional Variables			
CLOS			
Mean (SE)	52.1 (6.0)	56.3 (7.2)	47.8 (4.6)
Median	44.2	46.0	43.5
Range	16-192	16-192	19.5-100
Extubation time in hours			
Mean (SE)	10.3 (2.2)	14.3 (3.9)	6.1 (12.7)
Median	5.5	6.8	2.6
Range	0-120	2-120	0-47

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Glascow Coma Scale (GS): First and last			
First mean value (SE)	7.2	4.6	9.7
Last mean value (SE)	14.8	14.8	14.8
Range	1-15	1-15	2-15
Morbidity in CICU			
None	54 (83%)	25 (76%)	29 (91%)
Pacer placed	3 (5%)	2 (6%)	1 (3%)
Renal failure	3 (5%)	3 (9%)	0
Stroke	2 (3%)	1 (3%)	1 (3%)
Post-cardiotomy syndrome	1 (2%)	1 (3%)	0
Respiratory failure/ Pneumonia	2 (3%)	1 (3%)	1 (3%)
AICD placed	1 (2%)	0	1 (3%)
Pneumothorax, chest tube placed	1 (2%)	0	1 (3%)
Morbidity POD			
POD 1	3 (27%)	2 (25%)	1 (20%)
POD 2	4 (36%)	2 (25%)	2 (40%)
POD 3	1 (9%)	1 (13%)	0
POD 4	3 (27%)	1 (13%)	2 (40%)
POD 5	2 (18%)	2 (25%)	0
MI during Hospitalization			
None	62 (95%)	30 (91%)	32 (100%)
MI	3 (5%)	3 (9%)	0
Mortality in CICU			
None	65	33	32

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Reintubation after first extubation			
Yes	3 (5%)	2 (6%)	1 (3%)
No	62 (95%)	31 (94%)	31 (97%)
Reoperation			
Yes	0	0	0
No	65 (100%)	33 (100%)	32 (100%)
Survival to discharge from the CICU			
Yes	65 (100%)	33 (100%)	32 (100%)
No	0	0	0
Time of 1:1 nursing care in hours			
0 - 24	42 (65%)	19 (58%)	23 (72%)
24 - 48	17 (26%)	10 (30%)	7 (22%)
48 - 72	5 (8%)	3 (9%)	2 (6%)
72 - 96	0	0	0
96 - 120	0	0	0
120 - 144	1 (2%)	1 (3%)	0
Time until arterial line out (in hours)		N = 33	N = 31
Mean (SE)	31.8 (3.9)	37.9 (5.4)	29.5 (3.7)
Median	22.8	23.8	20.4
Range	16.5-248	16.5-149	0-194
Time until blake lines out (in hours)		N = 27	N = 27
Mean (SE)	24.8 (5.9)	25.3 (2.4)	24.4 (2.1)
Median	20.5	20	20.8
Range	16.5-70.5	16.8-91	16.5-50.8

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Time until bulb lines out (in hours)		N = 16	N = 10
Mean (SE)	24.8 (1.9)	19.8 (.8)	29.6 (2.9)
Median	missing	missing	missing
Range	16.5-123.0	16.5-123.0	16.5-50.8
Time until chest tubes out (in hours)		N = 7	N = 8
Mean (SE)	35.4 (5.5)	37.1 (7.0)	33.9 (8.7)
Median	26.0	38.0	24.8
Range	16.8-91.0	16.8-53.3	17.5-91.0
Time until pulmonary artery (PA) line out (in hours)			
Mean (SE)	26.4 (3.0)	31.7 (3.6)	20.9
Median	21.0	22.3	20.4
Range	M-92.5	14-92.5	M-74.0
Time until urinary catheter out (in hours)		N = 32	N = 28
Mean (SE)	28.5 (7.1)	40.8 (10.9)	20.9 (4.8)
Median	25.5	22.3	20.4
Range	M-288	14-M	M-173
Total blood output (bulb, Blake and chest tube) in cc's			
Mean (SE)	952 (74)	1120 (112)	772 (85.3)
Median	815	1090	700
Range	122-2762	275-2762	122-2520

Table 15 (Continued)

Variables of Comparison	All	CABG	OPCAB
Total urine output in cc's			
Mean (SE)	5011(671)	6067(794)	4154(547)
Median	3885	4445	3595
Range	11-19252	1665-19252	11-16738
Time to void spontaneously in hours			
Range	M-10.0	M-6.0	M-10.0

Note. M = missing data or did not have tube or line.

Table 16

CICU Variables: Significance Levels from Surgery, Age, and Gender Comparisons

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Physiological Variables			
Arrhythmia categories	.881	.200	.268
Arrhythmia duration	.431	.454	.287
BP's: outside 90-140 mm Hg systolic range	.664	.089	.178
Bowel function: first sound groups	.528	.939	.633
Bowel function: stool groups	.675	.351	.351
Code	.706	.746	.746
Code status	all full code		
Delirium	.349	.102	.477
Intraoperative or postoperative MI	.218	.592	.218
Laboratory values			
ABG			
pH	.384	.384	.394
CO_2	.345	.345	.368
O_2	.492	.508	.492
Ca++	.441	.423	.423
Creatinine	.560	.372	.408
Hematocrit	.296	.539	.702
K+	.261	.261	.515
Mg++	.004	.366	.476

Table 16 (Continued)

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Output, blood (bulb, Blake, and chest tube)	.018*[a]	.800	.109
Output, urine	.053*[a]	.203	.936
PA catheter values			
Cardiac index	.839	.170	.939
PCWP	.487	.079	.185
Temperature: admission, lowest and highest	.492	.492	.492
Provider Therapy Variables			
Colloid replacement			
CICU	.497	.557	.627
CICU and OR = total	.093	.659	.082
Consultants	.500	.500	.500
Crystalloid replacement			
CICU	.386	.671	.189
CICU and OR = total	.111	.670	.509
IABP use in hours	.349	.783	.449
Insulin IV drip	.083	.178	.570
Mobility to chair	.540	.461	.513
Pain medications			
DOS	.102	.828	.340
POD 1	.891	.355	.927
POD 2	.446	.924	.007**[e]
POD 3	.793	.005**[c]	.110
POD 4	.973	.331	.367
POD 5	.555	.864	.064

Table 16 (Continued)

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Pain medications			
POD 6	.666	.988	.102
POD 7	.446	.374	.001**[f]
POD 8	.469	.061	.728
POD 9	.754	.574	.360
Reintubation	.196	.611	.592
Transfusions			
RBC	.027*[a]	.683	.081
Platelet	.218	.592	.218
FFP	.218	.198	.611
Vasoactive intravenous medication/ hours of use			
Nitroglycerin	.251	.471	.742
Epinephrine	.589	.340	.547
Dopamine	.438	.118	.397
Nipride	.687	.499	.138
Neosynephrine	.297	.576	.131
Dobutamine	CABG only N=4	.324	.747
Time and Functional Variables			
CICU length of stay (LOS)	.324	.053*[d]	.615
Extubation, hours until	.060*[a]	.057*[c]	.421
GCS			
First	.001**[b]	.487	.221
Last	.329	.141	.329

Table 16 (Continued)

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Morbidity during medical center stay	N/S	N/S	N/S
Mortality during medical center stay	none		
Reoperation incidence	none		
Survival to discharge: CICU	all		
Time as 1:1 status	.061*[a]	.203	.504
Time to tubes/lines out			
Arterial	.213	.048*[d]	.867
Blake	.779	.078	.990
Bulb	.008**[b]	.722	.507
Catheter	.279	.061*[d]	.895
Chest	.785	.236	.418
NG	.657	.964	.867
PA	.140	.034*[d]	.575
Time to void spontaneously	.815	.078	.104

Note. * - clinical significance p= .01 - .065. ** - statistical significance p= .01 or less
[a]C>O. [b]O>C. [c]Y/O>O. [d]O>Y/O. [e]M>F. [f]F>M.
N/S = not significant.

Table 17

CICU Variables: Descriptive Data for Age Groups

Variables of Comparison	All	67-74	75-86
Physiological Variables			
Arrhythmias			
None	46 (72%)	25 (78%)	21 (64%)
Atrial fibrillation/flutter	11 (17%)	5 (16%)	6 (18%)
Ventricular tachycardia	3 (5%)	0	3 (9%)
Pacemaker use (temporary)	5 (8%)	2 (6%)	3 (9%)
Arrhythmia duration (hours)			
< 1 minute	2 (11%)	1 (14%)	1 (8%)
0 - 24 hours	10 (53%)	3 (43%)	7 (64%)
24 - 48 hours	1 (5%)	1 (14%)	0
48 – 72 hours	3 (16%)	1 (14%)	2 (18%)
72 – 96 hours	1 (5%)	0	1 (9%)
96-120 hours	1 (5%)	1 (14%)	0
120-144 hours	0	0	0
144-168 hours	0	0	0
168- 192 hours	0	0	0
192-216 hours	1 (5%)	0	1 (9%)
Missing data	1 (5%)	0	1 (9%)
Arterial blood gases – pH (normal 7.35-7.45)			
Normal	62 (95%)	32 (100%)	30 (91%)
< 7.2 x 1	1 (2%)	0	1 (3%)
< 7.2 x 2	1 (2%)	0	1 (3%)
> 7.55 x 2	1 (2%)	0	1 (3%)

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Arterial blood gases – CO_2 (normal 35-45)			
Normal	63 (97%)	30 (94%)	33 (100%)
< 35 x 1	1 (2%)	1 (3%)	0
> 60 x 1	1 (2%)	1 (3%)	0
Arterial blood gases – O_2 (normal 80-100)			
Normal	64 (98%)	32 (100%)	32 (97%)
< 80 x 2	1 (2%)	0	1 (3%)
Blood glucose values requiring insulin drip use			
Yes	33 (51%)	14 (44%)	19 (58%)
No	34 (52%)	18 (56%)	16 (42%)
Blood pressure			
Normal (90-140 mm Hg systolic)	29 (45%)	19 (59%)	10 (30%)
> 140 mm Hg	9 (14%)	1 (3%)	8 (24%)
< 90	26 (40%)	12 (38%)	14 (42%)
both > 140 and < 90	1 (2%)	0	1 (3%)
Bowel function: Hours to 1st bowel sounds			
0 - 24	51 (78%)	25 (78%)	26 (81%)
24 - 48	8(12%)	4 (13%)	4 (12%)
Missing data	6 (9%)	3 (9%)	3 (9%)
Bowel function: Days until recorded stool			
POD 1	6(9%)	3(9%)	3(9%)
POD 2	10(15%)	6(19%)	4(12%)
POD 3	13(20%)	8(25%)	5(15%)

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Bowel function: Days until recorded stool			
POD 4	12 (18%)	8 (25%)	4 (12%)
POD 5	7 (11%)	1 (3%)	6 (18%)
POD 6	2 (3%)	0	2 (6%)
POD 7	2 (3%)	0	2 (6%)
POD 8	0	0	0
POD 9	1 (2%)	1 (3%)	0
Missing data	12 (18%)	5 (16%)	7 (21%)
CLOS preoperative			
None	50 (77%)	25 (78%)	25 (76%)
0 - 24	9 (14%)	4 (13%)	5 (15%)
25 - 48	6 (9%)	3 (9%)	3 (9%)
CLOS postoperative			
0 - 24	12 (18%)	7 (22%)	5 (15%)
24 - 48	30 (46%)	17 (53%)	13 (39%)
48 - 72	8 (12%)	3 (9%)	5 (15%)
72 - 96	7 (11%)	4 (13%)	3 (9%)
96 - 120	5 (8%)	1 (3%)	4 (12%)
120 - 144	1 (2%)	0	1 (3%)
144 - 168	1 (2%)	0	1 (3%)
168 - 192	1 (2%)	0	1 (3%)
Code in CICU			
None	63 (97%)	31 (97%)	32 (100%)
One	2 (3%)	1 (3%)	1 (3%)
Code status in CICU			
Full code	65 (100%)	32 (100%)	33 (100%)

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Delirium behavior in CICU			
Yes	11 (17%)	3 (9%)	8 (24%)
No	54 (83%)	29 (97%)	25 (76%)
Calcium in CICU			
Normal (9.3 – 10.9 mg/dL)	58 (89%)	30 (94%)	28 (95%)
< 7.0	1 (2%)	0	1 (3%)
Missing data	6 (9%)	2 (6%)	4 (12%)
Creatinine in CICU			
Normal (0.6 – 1.3 mg/dL)	58 (9%)	31 (97%)	27 (82%)
>2.0 x 1	4 (6%)	1 (3%)	3 (9%)
> 2.0 x 2	1 (2%)	0	1 (3%)
> 2 x 4	1 (2%)	0	1 (3%)
> 2 x 13	1 (2%)	0	1 (3%)
Hematocrit in CICU			
Normal (40.0 – 53.0 g/dL)	46 (71%)	22	24 (73%)
< 25 x 1	12 (18%)	6 (19%)	6 (18%)
< 25 x 2	1 (2%)	0	1 (3%)
< 25 x 3	4 (6%)	3 (9%)	1 (3%)
< 25 < 4	1 (2%)	1 (3%)	0
Magnesium in CICU			
Normal (1.7 – 2.5 mg/dL)	49 (75%)	25 (19%)	24 (73%)
< 1.6	8 (12%)	3 (9%)	5 (15%)
< 1.6 x 2	2 (3%)	2 (6%)	0
Missing data	6 (9%)	2 (6%)	4 (12%)
Potassium in CICU			
Normal (3.7 – 5.5 mMol/L)	58 (89%)	27 (84%)	31 (94%)
< 3.0	2 (3%)	1 (3%)	1 (3%)

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Potassium in CICU			
> 5.5	1(2%)	0	1 (3%)
< 3.0 and > 5.5	2 (3%)	2 (6.3%)	0
Output in CICU in cc's:			
Total blood mean (SE)	952 (74)	932 (117)	970 (93)
Total blood median	815	795	830
Total blood range	122-2762	200-2762	122-2520
Total urine mean (SE)	5125 (496)	4500 (441)	5771 (895
Total urine median	3885	4209	3852
Total urine range	11-19252	1365-11889	11-19252
PA catheter values measuring left ventricular function			
Normal CI	35 (54%)	15 (50%)	20 (61%)
CI < 2.0 liters/minute x 1	12 (18%)	8 (25%)	4 (12%)
CI < 2.0 liters/minute x 2	5 (8%)	4 (13%)	1 (3%)
CI < 2.0 liters/minute x 3	5 (8%)	1 (3%)	4 (12%)
CI < 2.0 liters/minute x 4	3 (5%)	1 (3%)	2 (6%)
CI < 2.0 liters/minute x 5	2 (3%)	0	2 (6%)
No PA line	3 (5%)	3 (9%)	0
Normal PCWP	35 (54%)	15 (50%)	20 (61%)
PCWP > 18 mm Hg x 1	10 (15%)	8 (25%)	2 (6%)
PCWP > 18 mm Hg x 2	4 (6%)	3 (9%)	1 (3%)
PCWP > 18 mm Hg x 3	1 (2%)	1 (3%)	0
PCWP > 18 mm Hg x 4	3 (5%)	0	3 (9%)
PCWP > 18 mm Hg x 5	1 (2%)	0	1 (3%)
PCWP > 18 mm Hg x 6	3 (5%)	1 (3%)	2 (6%)
PCWP > 18 mm Hg x 7	5(8%)	1(3%)	4(12%)
No PA line	3(5%)	3(9%)	0

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Temperature in CICU			
Normal (35.0 – 37.0 C)	64 (98%)	31 (97%)	33 (100%)
> 38.5	1 (2%)	1 (3%)	0
Provider Therapy Variables			
Colloid use in CICU by type			
None	27 (42%)	13 (41%)	14 (43%)
Plasmanate	7 (11%)	6 (19%)	1 (3%)
Hetastarch	23 (35%)	9 (28%)	15 (36%)
FFP	1 (2%)	1 (3%)	0
Albumin	10 (15%)	3 (9%)	7 (21%)
Colloid total for CICU and OR (total) in cc's			
Mean (SE)	1567 (163)	1688 (189)	1470 (262)
Median	1501	1725	1501
Range	750-2350	1250-2050	750-2350
Consultants in CICU			
None	63 (97%)	31 (97%)	32 (97%)
Pulmonologist	1 (2%)	0	1 (3%)
Neurologist	1 (2%)	1 (3%)	0
Crystalloid Use in CICU in cc's			
Mean (SE)	1051 (160)	1121 (201)	983 (251)
Median	700	750	200
Range	0-5000	0-4600	0-5000
Crystalloid Total in OR and CICU			
Mean (SE)	3740 (224)	4254 (315)	3258 (298)
Median	3450	4300	3200
Range	800-8100	1550-8100	800-8100

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
IABP use – hours until discontinued			
None	52 (80%)	27 (84%)	25 (76%)
0 - 24	3 (5%)	1 (3%)	2 (6%)
24 - 48	6 (9%)	3 (9%)	3 (9%)
48 - 72	4 (6%)	1 (3%)	3 (9%)
Medications – Vasoactives use in CICU			
Nitroglycerin (NTG)-None	3 (5%)	1 (3%)	2 (6%)
Epinephrine (Epi)-None	46 (71%)	25 (76%)	21 (66%)
Dopamine-None	32 (49%)	14 (42%)	18 (56%)
Nipride-None	49 (75%)	25 (76%)	24 (75%)
Neosynephrine (Neo)-None	57 (88%)	28 (85%)	29 (91%)
Dobutamine-None	62 (95%)	32 (97%)	30 (94%)
Mobility – Hours until up to a chair			
0 – 24	47 (72%)	24 (75%)	23 (70%)
24 - 48	11 (17%)	7 ((22%)	4 (12%)
48 - 72	3 (5%)	1 (3%)	2 (6%)
72 - 96	1 (2%)	0	1 (3%)
96 - 120	1 (2%)	0	1 (3%)
120 - 144	1 (2%)	0	1 (3%)
Missing data	1 (2%)	0	1 (3%)
Pain medications - Morphine sulfate equivalencies			
DOS - N, Mean (SE)	65, 14.7 (11.7)	32, 15.0 (13.1)	33, 14.4 (10.3)
POD 1 - N, Mean (SE)	63, 19.0 (13.6)	32, 20.6 (14.8)	31, 17.4 (12.3)

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Pain medications - Morphine sulfate equivalencies			
POD 2 - N, Mean (SE)	53, 16.0 (14.1	26, 15.3 (14.6)	27, 15.7 (13.9)
POD 3 - N, Mean (SE)	47, 14.8 (15.7)	21, 21.8 (19.7)	25, 9.1 (8.2)
POD 4 - N, Mean (SE)	37, 14.6 (11.4)	19, 16.4 (11.9)	18, 12.7 (10.8)
POD 5 - N, Mean (SE)	20, 18.9 (13.5)	9, 19.4 (12.4)	11, 18.4 (15.0)
POD 6 - N, Mean (SE)	12, 14.9 (12.4)	4, 14.0 (12.1)	8, 15.0 (13.4)
POD 7 - N, Mean (SE)	8, 23.1 (10.8)	4, 19.4 (8.8)	4, 26.8 (12.6)
POD 8 - N, Mean (SE)	5, 20.0 (10.6)	2, 30.0 (7.1)	3, 13.3. (5.8)
POD 9 - N, Mean (SE)	4, 25.0 (13.5)	2, 30.0 (21.2)	2, 20.0 (NA)
Transfusions in CICU			
RBC None	31 (48%)	18 (56%)	13 (39%)
RBC 1 unit	13 (20%)	5 (16%)	8 (25%)
RBC 2 units	12 ((18%)	4 (13%)	8 (25%)
RBC 3 units	1 (2%)	0	1 (3%)
RBC 4 units	4 (6%)	3 (9%)	1 (3%)
RBC 5 units	2 (3%)	1 (3%)	1 (3%)
RBC 6 units	1 (2%)	1 (3%)	0
RBC 7 units	0	0	0
RBC 8 units	0	0	0
RBC 9 units	1 (2%)	0	1 (3%)

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Transfusions in CICU			
FFP None	62 (95%)	30 (94%)	32 (97%)
FFP 2 pack	2 (3%)	1 (3%)	1 (3%)
FFP 4 pack	1 (2%)	1 (3%)	0
Platelets None	62 (95%)	29 (91%)	33 (100%)
Platelets 10 pack x 2	2 (3%)	2 (6%)	0
Platelets 10 pack x 4	1 (2%)	1 (3%)	0
Time and Functional Variables			
CLOS in hours			
Mean (SE)	52.0 (5.7)	43.8 ( )	60.2 ( )
Median	44.3	42.5	46.0
Range	16-176	19.5-118	16-176
Extubation time in hours			
Mean (SE)	10.3 (2.2)	6.0 (1.1)	14.4 (4.1)
Median	5.5	4.8	6.8
Range	0-120	0-21	0-120
Glascow Coma Scale (GS): First and last			
First mean value (SD)	7.1 (4.6)	7.5 (4.7)	6.7 (4.5)
Last mean value (SD)	14.8 (.40)	14.9 (.33)	14.7 (.45)
Range	1-15	1-15	2-15
Morbidity in CICU			
None	54 (83%)	28 (88%)	26 (79%)
Pacer placed	3 (5%)	2 (6%)	1 (3%)
Renal Failure	3 (5%)	0	3 (9%)
Stroke	2 (3%)	1 (3%)	1 (3%)
Post-cardiotomy syndrome	1 (2%)	1 (3%)	0

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Morbidity in CICU			
Respiratory failure/ Pneumonia	3 (5%)	0	3 (9%)
AICD placed	1 (2%)	0	1 (3%)
Pneumothorax, chest tube placed	1 (2%)	0	1 (3%)
Morbidity POD	N = 11	N = 4	N = 7
POD 1	3 (27%)	1 (25%)	2 (20%)
POD 2	4 (36%)	1 (25%)	3 (30%)
POD 3	1 (2%)	0	1 (10%)
POD 4	2 (3%)	0	2 (20%)
POD 5	2 (3%)	2 (50%)	0
MI during hospitalization			
None	62 (95%)	30 (94%)	32 (97%)
MI	3 (5%)	2 (6%)	1 (3%)
Mortality in CICU			
None	65 (100%)	32 (100%)	33 (100%)
Reintubation after first extubation			
Yes	63 (97%)	31 (97%)	32 (97%)
No	2 (3%)	1 (3%)	1 (3%)
Reoperation			
Yes	0	0	0
No	65 (100%)	32 (100%)	33 (100%)
Survival to discharge from the CICU			
Yes	65 (100%)	32 (100%)	33 (100%)
No	0	0	0

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Time of 1:1 nursing care in hours			
0 - 24	45 (69%)	26 (81%)	19 (58%)
24 - 48	15 (23%)	5 (16%)	10 (30%)
48 - 72	4 (6%)	1 (3%)	3 (9%)
72 - 96	0	0	0
96 - 120	0	0	0
120 - 144	1 (2%)	0	1 (3%)
Time until arterial line out (in hours)		N = 32	N = 33
Mean (SE)	31.8 (3.9)	23.7 (4.5)	40.1 (5.9)
Median	22.8	21.5	24.0
Range	M-1485	M-63	7.5-148.5
Time until blake line out (in hours)	N = 54	N = 28	N = 26
Mean (SE)	25.0 (2.2)	22.1 (1.5)	27.8 (2.8)
Median	20.5	19.4	21.0
Range	M-70.5	M-46.3	M-70.5
Time until bulb line out (in hours)	N = 26	N = 10	N = 16
Mean (SE)	23.5 (2.2)	22.9 (1.5)	24.0 (2.3)
Median	20.5	19.4	21.0
Range	M-51	M-32	M-51
Time until chest tube out (in hours)		N = 8	N = 7
Mean (SE)	35.4 (5.5)	29.2 (4.2)	42.6 (10.5)
Median	26.0	25.9	26.0
Range	16.8-91.0	16.8-45.5	18.5-91.0

Table 17 (Continued)

Variables of Comparison	All	67-74	75-86
Time until pulmonary artery (PA) line out (in hours)		N = 32	N = 33
Mean (SE)	26.4 (3.0)	19.4 (4.2)	33.2 (4.1)
Median	21.0	21.0	28.0
Range	M-92.5	M-46.25	6.8-92.5
Time until urinary catheter out (in hours)	N = 60	N = 32	N = 30
Mean (SE)	28.5 (7.1)	28.2 (2.9)	50.2 (11.1)
Median	25.5	23.6	26.5
Range	M-288	M-63.0	M-288
Total blood (Blake, bulb and chest tube) output in cc's			
Mean (SE)	951 (106)	932 (118)	970 (93)
Median	815	795	830
Range	122-2762	200-2762	122-2520
Total urine output in cc's			
Mean (SE)	5136 (668)	4500 (441)	5771 (895)
Median	3885	4209	3852
Range	11-19252	1365-11889	11-19252

Note. M = missing data or did not have tube or line.

young-old. It was surprising to note that 1:1 nursing care time did not vary based on age.

Gender Groups

Descriptive data for CICU variables of the gender groups are presented in Table 18.

Table 16 presents results of statistical comparison between the gender groups. The statistically significant finding between genders was that males received significantly more morphine sulfate (MS) on POD 2 (p= .007) and morphine use on POD 7 was greater for females than males (p= .001). Of clinical significance was the finding that females received more MS on POD 5 (p= .060). There were no other significant findings of nursing interest, other than to say subjects were not different based on all other variables tested.

Ward Period

Surgery Groups

Descriptive data for ward variables of the surgery groups are presented in Table 19.

Table 20 presents results of statistical comparison between the surgery groups.

There were no statistically different findings within the surgery groups. Findings of clinical significance include: discharge inotropes were prescribed by the surgeons more for OPCAB subjects than CABG subjects (p= .029) and the HLOS was longer for the CABG subjects than the OPCAB subjects (p= .052).

Table 18

CICU Variables: Descriptive Data for Gender Groups

Variables of Comparison		Male	Female
Physiological Variables			
Arrhythmias			
None	44 (68%)	21 (64%)	23 (72%)
Atrial fibrillation/flutter	11 (17%)	8 (24%)	3 (9%)
Ventricular tachycardia/ PVC's	3 (5%)	2 (6%)	1 (3%)
Pacemaker use (temporary)	5 (8%)	2 (6%)	3 (9%)
Previous pacemaker	2 (3%)	0	2 (6%)
Arrhythmia duration (hours)			
< 1 minute	1 (5%)	1 (8%)	0
0 - 24 hours	8 (42%)	8 (67%)	0
24 - 48 hours	1 (5%)	1 (8%)	0
48 – 72 hours	1 (5%)	0	1 (14%)
72 – 96 hours	3 (16%)	1 (8%)	2 (28%)
96-120 hours	0	0	0
120-144 hours	1 (5%)	1 (8%)	0
144-168 hours	0	0	0
168- 192 hours	0	0	0
192-216 hours	1 (5%)	0	1 (14%)
Missing data	3 (16%)	0	3 (43%)
Arterial blood gases – pH (normal 7.35-7.45)			
Normal	62 (95%)	31 (94%)	31 (97%)
<7.2 x 1	1 (2%)	1 (3%)	0
< 7.2 x 2	1 (2%)	1 (3%)	0
> 7.55 x 2	1 (2%)	0	1 (3%)

Table 18 (Continued)

Variables of Comparison		Male	Female
Arterial blood gases – cO2 (normal 35-45)			
Normal	63 (97%)	32 (97%)	31 (97%)
< 35 x 1	2 (3%)	1 (3%)	1 (3%)
Arterial blood gases – O2 (normal 80-100)			
Normal	64 (98%)	33 (100%)	31 (97%)
< 80 x 2	1 (2%)	0	1 (3%)
Blood glucose values requiring insulin drip use			
Yes	30 (46%)	16 (49%)	14 (44%)
No	35 (54%)	17 (52%)	18 (56%)
Blood pressure			
Normal (90-140 mm Hg systolic)	29 (45%)	14 (42%)	15 (47%)
> 140 mm Hg	9 (14%)	2 (6%)	7 (22%)
< 90	26 (40%)	16 (49%)	10 (31%)
both > 140 and < 90	1 (2%)	1 (3%)	0
Bowel function: Hours to 1st bowel sounds			
0 - 24	53 (82%)	25 (76%)	28 (88%)
24 - 48	6 (9%)	4 (12%)	2 (6%)
Missing data	6 (9%)	4 (12%)	2 (6%)
Bowel function: Days until recorded stool			
POD 1	6 (9%)	4 (3%)	2 (6%)
POD 2	10 (15%)	6 (18%)	4 (13%)
POD 3	13 (20%)	5 (15%)	8 (25%)
POD 4	12 (18%)	8 (24%)	4 (13%)

Table 18 (Continued)

Variables of Comparison		Male	Female
Bowel function: Days until recorded stool			
POD 5	7 (11%)	6 (18%)	1 (3%)
POD 6	2 (3%)	0	2 (6%)
POD 7	2 (3%)	0	2 (6%)
POD 8	0	0	0
POD 9	1 (2%)	0	1 (3%)
Missing data	12 (18%)	4 (12%)	8 (25%)
CLOS preoperative			
None	50 (77%)	28 (85%)	22 (69%)
0 - 24	10 (15%)	3 (9%)	7 (22%)
25 - 48	5 (8%)	2 (6%)	3 (9%)
CLOS postoperative			
0 - 24	12 (18%)	7 (21%)	5 (16%)
24 - 48	30 (46%)	16 (46%)	14 (44%)
48 - 72	8 (12%)	4 (12%)	4 (13%)
72 - 96	7 (11%)	3 (9%)	4 (13%)
96 - 120	5 (8%)	2 (6%)	3 (9%)
120 - 144	1 (2%)	0	1 (3%)
144 - 168	1 (2%)	0	1 (3%)
168 - 192	1 (2%)	1 (3%)	0
Code in CICU			
None	63 (97%)	32 (97%)	31 (97%)
One	2 (3%)	1 (3%)	1 (3%)
Code status in CICU			
Full code	65 (100%)	33 (100%)	32 (100%)

Table 18 (Continued)

Variables of Comparison		Male	Female
Delirium behavior in CICU			
Yes	11 (17%)	5 (15%)	6 (19%)
No	54 (83%)	28 (85%)	26 (81%)
Calcium in CICU			
Normal (9.3 – 10.9 mg/dL)	58 (89%)	30 (91%)	28 (88%)
< 7.0	1 (2%)	1 (3%)	0
Missing data	6 (9%)	2 (6%)	4 (13%)
Creatinine in CICU			
Normal (0.6 – 1.3 mg/dL)	58 (89%)	29 (88%)	29 (91%)
>2.0 x 1	4 (6%)	3 (9%)	1 (3%)
> 2.0 x 2	1 (2%)	0	1 (3%)
> 2 x 4	1 (2%)	0	1 (3%)
> 2 x 13	1 (2%)	1 (3%)	0
Hematocrit in CICU			
Normal - not less than 25	47 (72%)	24 (73%)	23 (72%)
< 25 x 1	12 (18%)	6 (18%)	6 (19%)
< 25 x 2	1 (2%)	0	1 (3%)
< 25 x 3	4 (6%)	2 (6%)	2 (6%)
< 25 < 4	1 (2%)	1 (3%)	0
Magnesium in CICU			
Normal (1.7 – 2.5 mg/dL)	49 (75%)	27 (82%)	22 (69%)
< 1.6	8 (12%)	2 (6%)	6 (19%)
< 1.6 x 2	2 (3%)	1 (3%)	1 (3%)
Missing data	6 (9%)	3 (9%)	3 (9%)

Table 18 (Continued)

Variables of Comparison		Male	Female
Potassium in CICU			
Normal (3.7 – 5.5 mMol/L)	58 (89%)	31 (94%)	27 (84%)
< 3.0	2 (3%)	0	2 (6%)
> 5.5	3 (5%)	1 (3%)	2 (6%)
< 3.0 and > 5.5	2 (3%)	1 (3%)	1 (3%)
Output in CICU in cc's:			
Total Blood Mean (SE)	951 (74)	1070 (112)	833 (94)
Total Blood Median	815	885	773
Total Blood Range	122-2762	285-2762	122-2385
Total Urine Mean (SE)	5125 (496)	5165 (738)	5085 (673)
Total Urine Median	3885	3740	4022
Total Urine Range	11-19252	1473-19252	11-16737
PA catheter values measuring left ventricular function			
Normal CI	35 (54%)	19 (58%)	16 (50%)
CI < 2.0 liters/minute x 1	12 (18%)	5 (15%)	7 (22%)
CI < 2.0 liters/minute x 2	5 (8%)	3 (9%)	2 (6%)
CI < 2.0 liters/minute x 3	5 (9%)	3 (9%)	2 (6%)
CI < 2.0 liters/minute x 4	3 (5%)	1 (3%)	2 (6%)
CI < 2.0 liters/minute x 5	2 (3%)	1 (3%)	1 (3%)
No PA line	3 (5%)	1 (3%)	2 (6%)
Normal PCWP	35 (54%)	13 (39%)	22 (69%)
PCWP > 18 mm Hg x 1	10 (15%)	7 (21%)	3 (9%)
PCWP > 18 mm Hg x 2	4 (6%)	3 (9%)	1 (3%)
PCWP > 18 mm Hg x 3	1 (2%)	0	1 (3%)

Table 18 (Continued)

Variables of Comparison		Male	Female
PA catheter values measuring left ventricular function			
PCWP > 18 mm Hg x 4	3 (5%)	2 (6%)	1 (3%)
PCWP > 18 mm Hg x 5	1 (2%)	1 (3%)	0
PCWP > 18 mm Hg x 6	3 (5%)	1 (3%)	2 (6%)
PCWP > 18 mm Hg x 7	3 (5%)	3 (9%)	0
PCWP > 18 mm Hg x 8	1 (2%)	1 (3%)	0
PCWP > 18 mm Hg x 11	3 (5%)	1 (3%)	2 (6%)
No PA line	1 (2%)	1 (3%)	0
Temperature in CICU			
Normal (35.0 – 37.0 C)	64 (98%)	33 (100%)	31 (97%)
>38.5	1 (2%)	0	1 (3%)
Provider Therapy Variables			
Colloid use in CICU by type			
None	28 (43%)	14 (43%)	14 (43%)
Plasmanate	1 (2%)	0	1 (3%)
Hetastarch	26 (40%)	14 (42%)	12 (38%)
FFP	1 (2%)	1 (3%)	0
Albumin	9 (14%)	4 (12%)	5 (15%)
Colloid use in CICU in cc's			
Mean (SE)	548 (79)	618 (126)	476 (95)
Median	500	250	500
Range	0-2250	0-2250	0-1500
Colloid for OR and CICU (Total)			N = 1
Mean (SE)	1567 (163)	1575 (184)	1501 (NA)
Median	1501	1525	1501
Range	750-2350	750-2350	NA

Table 18 (Continued)

Variables of Comparison		Male	Female
Consultants in CICU			
None	63 (97%)	33 (100%)	30
Pulmonologist	1 (2%)	0	1 (3%)
Neurologist	1 (2%)	0	1 (3%)
Crystalloid use in CICU in cc's			
Mean (SE)	1051 (160)	1259 (241)	836 (207)
Median	700	840	100
Range	0-5000	0-5000	0-4500
Crystalloid total in OR and CICU			
Mean (SE)	3731 (224)	4028 (322)	3434 (305)
Median	3450	3700	3200
Range	800-8100	800-8000	800-8100
IABP use – hours until discontinued			
None	52 (80%)	26 (79%)	26 (81%)
0 - 24	6 (9%)	1 (3%)	5 (16%)
24 - 48	2 (3%)	2 (6%)	0
48 - 72	5 (8%)	4 (12%)	1 (3%)
Medications – Vasoactives Use in CICU			
Nitroglycerin (NTG)-None	3 (5%)	2 (6%)	1 (3%)
Epinephrine (Epi)-None	46 (71%)	25 (76%)	21 (66%)
Dopamine -None	32 (49%)	17 (52%)	15 (48%)
Nipride -None	49 (75%)	26 (79%)	23 (72%)
Neosynephrine (Neo)-None	57 (88%)	28 (43%)	29 (91%)
Dobutamine -None	62 (95%)	31 (94%)	31 (97%)

Table 18 (Continued)

Variables of Comparison		Male	Female
Mobility – Hours until up to a chair			
	0 – 24	57 (88%)	24 (73%)	23 (72%)
	24 - 48	11 (17%)	3 (9%)	8 (25%)
	48 - 72	3 (5%)	3 (9%)	0
	72 - 96	1 (2%)	0	1 (3%)
	96 - 120	1 (2%)	1 (3%)	0
	120 - 144	1 (2%)	1 (3%)	0
	Missing data	1 (2%)	1 (3%)	0
Pain medications - Morphine sulfate equivalencies			
	DOS - N, Mean (SE)	65, 14.7 (11.7)	33, 16.1 (11.6)	32, 13.3 (11.7)
	POD 1 - N, Mean (SE)	63, 19.0 (13.6)	33, 18.9 (14.6)	30, 19.2 (12.8)
	POD 2 - N, Mean (SE)	53, 15.5 (14.0)	25, 20.9 (17.1)	28, 10.7 (8.6)
	POD 3 - N, Mean (SE)	47, 14.8 (15.7)	22, 18.7 (18.8)	25, 11.3 (11.8)
	POD 4 - N, Mean (SE)	37, 14.6 (11.4)	17, 12.7 (13.0	20, 16.2 (10.0)
	POD 5 - N, Mean (SE)	20, 18.9 (13.5)	11, 13.8 (12.7)	9, 25.0 (13.0)
	POD 6 - N, Mean (SE)	12, 14.9 (12.4)	6, 9.1 (9.5)	6, 20.8 (12.8)
	POD 7 - N, Mean (SE)	8, 23.1 (11.8)	5, 15.9 (4.5)	3, 35.0 (5.0)
	POD 8 - N, Mean (SE)	5, 20.0 (10.6)	2, 22.5 (17.7)	3, 18.3 (7.6)
	POD 9 - N, Mean (SE)	4, 25.0 (13.5)	2, 32.5 (17.7)	2, 17.5 (3.5)

Table 18 (Continued)

Variables of Comparison		Male	Female
Transfusions in CICU			
RBC None	31 (48%)	18 (55%)	13 (41%)
RBC 1 unit	13 (20%)	3 (9%)	10 (31%)
RBC 2 units	12 (18%)	5 (15%)	7 (22%)
RBC 3 units	1 (2%)	1 (3%)	0
RBC 4 units	4 (6%)	3 (9%)	1 (3%)
RBC 5 units	2 (3%)	1 (3%)	1 (3%)
RBC 6 units	1 (2%)	1 (3%)	0
RBC 7 units	0	0	0
RBC 8 units	0	0	0
RBC 9 units	1 (2%)	1 (3%)	0
FFP None	62 (95%)	31 (94%)	31 (97%)
FFP 2 pack	2 (3%)	1 (3%)	1 (3%)
FFP 4 pack	1 (2%)	1 (3%)	0
Platelets None	62 (95%)	30 (91%)	32 (100%)
Platelets 10 pack x 2	2 (3%)	2 (6%)	0
Platelets 10 pack x 4	1 (2%)	1 (3%)	0
Time and Functional Variables			
CLOS			
Mean (SE)	52.2 (6.1)	50.0 (6.3)	54.3 (5.8)
Median	44.0	41.5	54.3
Range	16-192	19.5-192	16-144
Extubation time in hours			
Mean	10.3 (2.2)	12.0 (3.8)	8.5 (2.1)
Median	5.5	4.8	5.6
Range	0-120	0-120	0-68

Table 18 (Continued)

Variables of Comparison		Male	Female
Glascow Coma Scale (GS): First and last			
First mean value (SE)	7.1 (.4)	7.8 (.3)	6.4 (.5)
Last mean value (SE)	14.8 (.34)	14.8 (.3)	14.8 (.36)
Range	1-15	2-15	1-15
Morbidity in CICU			
None	54 (83%)	27 (82%)	27 (84%)
Pacer placed	3 (5%)	2 (6%)	1 (3%)
Morbidity in CICU			
Renal failure	3 (5%)	2 (6%)	1 (3%)
Stroke	2 (3%)	0	2 (6%)
Post-cardiotomy syndrome	1 (2%)	1 (3%)	0
Respiratory failure/ Pneumonia	3 (5%)	2 (6%)	1 (3%)
AICD placed	1 (2%)	1 (3%)	0
Pneumothorax, chest tube placed	1 (2%)	0	1 (3%)
Morbidity POD			
POD 1	3 (21%)	2 (25%)	1 (17%)
POD 2	4 (29%)	1 (13%)	3 (50%)
POD 3	2 (14%)	1 (13%)	1 (17%)
POD 4	3 (21%)	3 (38%)	0
POD 5	2 (14%)	1 (13%)	1 (17%)
MI during hospitalization			
None	62 (95%)	30 (91%)	32 (100%)
MI	3 (5%)	3 (9%)	0
Mortality in CICU			
None	65 (100%)	35 (100%)	32 (100%)

Table 18 (Continued)

Variables of Comparison		Male	Female
Reintubation after first extubation			
Yes	62 (95%)	32 (97%)	30 (94%)
No	3 (5%)	1 (3%)	2 (6%)
Reoperation			
Yes	0	0	0
No	65 (100%)	33 (100%)	32 (100%)
Survival to discharge from the CICU			
Yes	65 (100%	33 (100%)	32 (100%)
No	0	0	0
Time of 1:1 nursing care in hours			
0 - 24	42 (65%)	22 (67%)	20 (63%)
24 - 48	17 (26%)	9 (27%)	8 (25%)
48 - 72	5 (8%)	1 (3%)	4 (13%)
72 - 96	0	0	0
96 - 120	0	0	0
120 - 144	1 (2%)	1 (3%)	0
Time until arterial lines out (in hours)			
Mean (SE)	31.8 (3.9)	33.3 (4.8)	30.2 (6.18)
Median	22.8	22.5	22.8
Range	M-148.5	7.5-148.5	M-124
Time until blake lines out (in hours)	N=54	N = 27	N = 27
Mean (SE)	25 (2.3)	25 (2.4)	25 (2.2)
Median	25	25	25
Range	M-70.5	M-70.5	M-53.0

Table 18 (Continued)

Variables of Comparison		Male	Female
Time until bulb lines out (in hours)	N=26	N=12	N=14
Mean (SE)	23.8 (2.3)	25 (2.7)	22.6 (1.7)
Median	24	25	23
Range	M-50.8	M-50.8	M-39
Time until chest tubes out (in hours)	N=15	N=4	N=11
Mean (SE)	35.4 (5.5)	43 (17)	33 (4.7)
Median	M	M	M
Range	16.8-91	17.5-91	16.8-70.0
Time until pulmonary artery line out (in hours)	N=63	N=32	N=31
Mean (SE)	26.5 (3.0)	30 (3.8)	27 (2.7)
Median	21.0	21.0	21.8
Range	M-92.5	M-92.5	M-71.3
Time until urinary catheter out (in hours)	N=60	N=30	N=30
Mean (SE)	28.5 (10.9)	26 (10.0)	31 (9.3)
Median	25.5	24.3	26.4
Range	M-288	M-288	M-216
Total blood output (Blake, bulb and chest tube) in cc's			
Mean (SE)	951 (103)	1070 (112)	832 (94)
Median	815	885	773
Range	122-2762	285-2762	122-2385
Total urine output in cc's			
Mean (SE)	5125 (706)	5165 (738)	5085 (673)
Median	3885	3740	4022
Range	11-19252	1472-19252	11-16737

Note. M = missing data or did not have tube or line.

Table 19

Ward Variables: Descriptive Data for Surgery Groups

Variables of Comparison		CABG	OPCAB
Physiological Variables			
Arrhythmias			
None	44 (68%)	23 (70%)	21 (66%)
Atrial fibrillation/flutter	21 (32%)	10 (30%)	11 (34%)
Arrhythmia duration in hours			
0 - 24	9 (43%)	5 (50%)	4 (36%)
24 - 48	5 (24%)	4 (40%)	1 (9%)
48 - 72	2 (10%)	1 (10%)	1 (9%)
72 - 96	3 (14%)	0	3 (27%)
96 - 120	1 (5%)	0	1 (9%)
120 - 144	1 (5%)	0	1 (9%)
Blood pressures			
Normal (90-140 mm Hg systolic)	62 (95%)	31 (94%)	31 (97%)
> 140 systolic	3 (5%)	2 (6%)	1 (3%)
< 90	0	0	0
both >140 and <90	0	0	0
Code			
Yes	0	0	0
No	65	33	32
Temperature			
Normal	65	33	32
Missing data	0	0	0

Table 19 (Continued)

Variables of Comparison		CABG	OPCAB
Provider Therapy Variables			
Consultants on ward			
None	63 (97%)	33 (100%)	30
Pulmonologist	1 (2%)	0	1 (3%)
Neurologist	1 (2%)	0	1 (3%)
Medications Preoperative vs. Postoperative	N / %		
Beta-blockers pre	39/60	23/69	16/50
Beta blockers post	48/74	25/76	23/72
ACE inhibitors pre	23/35	12/36	11/34
ACE post	11/17	4/12	7/29
Lipid lowering agents pre	30/46	18/55	12/38
Lipid lowering post	22/34	11/33	11/34
Calcium channel blockers pre	20/31	11/33	9/28
Calcium channel blockers post	18/28	9/27	2/28
Analgesics pre	5/8	1/3	4/13
Analgesics post	62/95	32/97	30/94
H_2 blockers pre	5/8	2/6	3/9
H_2 blockers post	10/15	3/9	7/22
Proton pump inhibitor pre	6/9	4/12	2/6
Proton pump inhibitor post	8/12	4/12	4/13
Diuretics pre	22/34	12/36	10/31
Diuretics post	44/68	24/73	20/63
Antibiotics pre	2/3	1/3	1/3
Antibiotics post	5/8	3/9	2/6
Inhaler (s) pre	8/12	3/9	5/16

Table 19 (Continued)

Variables of Comparison		CABG	OPCAB
Medications			
Inhaler (s) post	9/14	4/12	5/16
Herbal (s) pre	3/5	3/9	0
Herbal (s) post	0	0	0
Multi-vitamins pre	16/25	8/24	8/25
Multi-vitamins post	5/8	1/3	4/13
Iron pre	3/5	2/6	1/3
Iron post	20/31	10/30	10/31
Antithrombotic pre	41/63	23/70	18/56
Antithrombotic post	62/95	32/97	30/94
Oral agent for diabetes pre	12/19	7/21	5/16
Oral agent for diabetes post	11/17	6/18	6/16
Insulin pre	3/5	2/6	1/3
Insulin post	3/5	1/3	2/6
Nitrate pre	36/55	19/58	17/53
Nitrate post	2/3	1/3	1/3
Inotrope pre	10/15	6/18	4/13
Inotrope post	22/34	7/21	15/47
Antiarrhythmic pre	3/5	2/6	1/3
Antiarrhythmic post	23/35	11/33	12/38
Hormone replacement pre	18/28	9/27	9/28
Hormone replacement post	10/15	3/9	7/22
Alpha II blocker pre	4/6	3/9	1/3
Alpha II blocker post	1/2	0	1/3
Thyroid pre	10/15	6/18	4/13
Thyroid post	6/9	4/12	2/6

Table 19 (Continued)

Variables of Comparison		CABG	OPCAB
Medications			
SSRI pre	5/8	2/6	3/9
SSRI post	4/6	1/3	8/25
Time and Functional Variables			
Ward LOS in days			
Mean (SE)	2.2 (4.3)	2.3 (7.2)	2.0 (4.5)
Median	1.8	1.9	1.8
Range	.65-8.0	.65-8.0	.8-4.1
HLOS in days			
Mean (SE)	6.4 (.33)	7.0 (.52)	5.7 (.4)
Median	6.0	6.0	5.0
Range	3.0- 15.0	3.0-15.0	3.0-11.0
Survival to hospital discharge	65 (100%)	33 (100%)	32 (100%)
Discharge destination			
Home	57 (88%)	28 (85%)	29 (91%)
Home health to follow	2 (3%)	1 (3%)	1 (3%)
SNF	3 (5%)	2 (6%)	1 (3%)
Hospital rehab	2 (3%)	1 (3%)	1 (3%)
Child's home	1 (2%)	1 (3%)	0

Table 20

Ward Variables: Significance Levels from Surgery, Age, and Gender Group Comparison

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Physiological Variables			
Arrhythmia categories	.575	.849	.755
Arrhythmia duration	.279	.458	.482
BP: outside 90-140 mm Hg systolic range	.512	.711	.613
Code	none		
Temperature: highest and lowest	no one was febrile or < 35.0 Celcius		
Provider Therapy Variables			
Consultants	.500	.500	.500
Medications			
Beta blockers	.722	.357	.357
ACE	.294	.783	.699
Lipid lowering agent (LLA)	.929	.097	.255
Calcium channel blocker (CCB)	.939	.633	.528
Analgesic	.536	.114	.125
H_2 blocker	.153	.526	.459
Diuretic	.378	.726	.158
Antibiotic	.667	.168	.515
Inhaler	.480	.119	.253
Vitamins	.168	.485	.268
Herbals	none prescribed		
Iron	.934	.934	.535

Table 20 (Continued)

Variables of Comparison	Surgery Groups	Age Groups	Gender Groups
Medications			
Antithrombotic	.488	.512	.512
Oral agent	.783	.699	.477
Insulin	.613	.613	.613
Nitrate	.746	.254	.238
Proton pump inhibitor	.628	.337	1.000
Inotrope	.029	.540	.337
Antiarrhythmic	.725	.867	.085
Hormone	.139	.958	.000**[b]
Alpha II blocker	.318	.508	1.000
Thyroid	.351	.649	.000**[b]
SSRI	.295	.682	.682
Time and Functional Variables			
Discharge destination	.828	.149	.388
HLOS	.052[a]	.200	.633
Survival to medical center discharge	all	all	all

Note. * - clinical significance p= .01 - .065. ** - statistical significance p= .01 or less
[a]C>O. [b]F>M

Age Groups

Descriptive data for ward variables of the age groups are presented in Table 21. Table 20 presents results of statistical comparison between the age groups.

There were no statistical or clinically significant findings between age groups among the ward variables.

Gender Groups

Descriptive data for ward variables of the gender groups are presented in Table 22.

Table 20 presents results of statistical comparison between the gender groups.

Upon discharge from the Medical Center, gender groups differed statistically in the number of HRT prescriptions (female > male p= .000) and thyroid prescriptions (female > male p= .011). From a clinical and nursing perspective, it was interesting to note that more of the older subjects were discharged to a location other than their home for recovery (nursing home, skilled care, child's home or rehabilitation, p= .388).

MIDCAB Subjects

Summary of Important Findings

The MIDCAB sample is most like the young-old in terms of mean age, with more females than males. All MIDCAB subjects were Caucasian and married. The total sample had 60% married and 95% Caucasian subjects.

Comorbidities are more severe than the total sample of 65 based on all three having a previous CABG operation (there were four in the total sample of 65), with one

Table 21

Ward Variables: Descriptive Data for Age Groups

Variables of Comparison	All	67-74	75-86
Physiological Variables			
Arrhythmias			
None	43 (65%)	21 (66%)	21 (64%)
Atrial fibrillation/flutter	22 (34%)	11 (34%)	11 (33%)
Paced, temporary	1 (2%)	0	1 (3%)
Arrhythmia duration in hours	N = 23	N = 11	N = 12
0 - 24	12 (52%)	7 (64%)	5 (42%)
24 - 48	3 (13%)	0	3 (25%)
48 - 72	5 (22%)	2 (18%)	3 (25%)
72 - 96	1 (4%)	0	1 (8%)
96 - 120	2 (9%)	2 (18%)	0
Blood pressures			
Normal (90-140 mm Hg systolic)	62 (95%)	31 (97%)	31 (94%)
> 140 systolic	3 (5%)	1 (3%)	2 (6%)
< 90	0	0	0
both > 140 and < 90	0	0	0
Code			
Yes	0	0	0
No	65 (100%)	32 (100%)	33 (100%)
Temperature			
Normal	62 (100%)	32 (100%)	33 (100%)
Missing data	0	0	0

Table 21 (Continued)

Variables of Comparison	All	67-74	75-86
Provider Therapy Variables			
Consultants on ward			
None	63 (97%)	33 (100%)	30
Pulmonologist	1 (2%)	0	1 (3%)
Neurologist	1 (2%)	0	1 (3%)
Medications preoperative vs. postoperative		67-74	75-86
Beta-blockers pre	39 (60%)	18 (56%)	21 (64%)
Beta blockers post	48 (74%)	22 (69%)	26 (79%)
ACE inhibitors pre	23 (35%)	12 (38%)	11 (33%)
ACE post	11 (17%)	5 (16%)	6 (18%)
Lipid lowering agents pre	30 (46%)	13 (41%)	17 (52%)
Lipid lowering post	22 (34%)	14 (44%)	8 (24%)
Calcium channel blockers pre	20 (31%)	10 (32%)	10 (30%)
Calcium channel blockers post	18 (28%)	8 (25%)	10 (30%)
Analgesics pre	5 (8%)	2 (6%)	3 (9%)
Analgesics post	62 (95%)	29 (91%)	33 (100%)
H2 blockers pre	5 (8%)	4 (13%)	1 (3%)
H2 blockers post	10 (15%)	4 (13%)	6 (18%)
Proton pump inhibitor pre	6 (9%)	3 (9%)	3 (9%)
Proton pump inhibitor post	8 (12%)	5 (16%)	3 (9%)
Diuretics pre	22 (34%)	10 (31%)	12 (36%)
Diuretics post	44 (68%)	21 (66%)	23 (70%)
Antibiotics pre	2 (3%)	2 (6%)	0
Antibiotics post	5 (8%)	4 (13%)	1 (3%)

Table 21 (Continued)

Variables of Comparison	All	67-74	75-86
Medications preoperative vs. postoperative			
Inhaler (s) pre	8 (12%)	6 (19%)	2 (6%)
Inhaler (s) post	9 (14%)	5 (16%)	4 (12%)
Herbal (s) pre	4 (6%)	0	4 (12%)
Herbal (s) post	3 (5%)	0	3 (9%)
Multi-vitamins pre	16 (25%)	9 (28%)	7 (21%)
Multi-vitamins post	5 (8%)	3 (9%)	2 (6%)
Iron pre	3 (5%)	1 (3%)	2 (6%)
Iron post	20 (31%)	10 (31%)	10 (30%)
Antithrombotic pre	41 (63%)	17 (53%)	24 (73%)
Antithrombotic post	62 (95%)	31 (97%)	31 (94%)
Oral agent for diabetes pre	12 (18%)	6 (19%)	6 (18%)
Oral agent for diabetes post	11 (17%)	6 (19%)	5(15%)
Insulin pre	3(5%)	2(6%)	1(3%)
Insulin post	4(6%)	2(6%)	2(6%)
Nitrate pre	36(55%)	19(59%)	17(52%)
Nitrate post	2(3%)	0	2(6%)
Inotrope pre	10(15%)	4(13%)	6(18%)
Inotrope post	22(34%)	12(38%)	10(30%)
Antiarrhythmic pre	3(5%)	1(3%)	2(6%)
Antiarrhythmic post	23(35%)	11(34%)	12(36%)
Hormone replacement pre	18(28%)	9(28%)	9(27%)
Hormone replacement post	10(15%)	5(16%)	5(15%)
Alpha II blocker pre	4(6%)	1(3%)	3(9%)
Alpha II blocker post	1(2%)	0	1(3%)

Table 21 (Continued)

Variables of Comparison	All	67-74	75-86
Medications preoperative vs. postoperative			
Thyroid pre	10(15%)	4(13%)	6(18%)
Thyroid post	6(9%)	3(9%)	3(9%)
SSRI pre	5(8%)	3(9%)	2(6%)
SSRI post	5(8%)	3(9%)	2(6%)
Time and Functional Variables			
Ward LOS in days			
Mean (SE)	2.3 (2.6)	1.8 (2.0)	2.5 (3.5)
Median	1.8	1.8	1.9
Range	.65-8.0	.8-4.9	.65-8.0
HLOS in days			
Mean (SE)	6.4 (.33)	5.9 (.43)	6.8 (.49)
Median	6.0	5.0	6.0
Range	3-15	3-15	3-15
Survival to hospital discharge	65 (100%)	32 (100%)	33 (100%)
Discharge destination			
Home	57 (88%)	30 (94%)	27 (82%)
Home health to follow	2 (3%)	1 (3%)	1 (3%)
SNF	3 (5%)	0	3 (9%)
Hospital rehab	2 (3%)	0	2 (6%)
Child's home	1 (2%)	1 (3%)	0

Table 22

Ward Variables: Descriptive Data for Gender Groups

Variables of Comparison	All	Male	Female
Physiological Variables			
Arrhythmias			
None	41 (63%)	20 (61%)	21 (66%)
Atrial fibrillation/flutter	22 (34%)	13 (39%)	9 (28%)
Missing data	2 (3%)	0	2 (6%)
Arrhythmia duration in hours			
0 - 24	9 (39%)	5 (38%)	4 (40%)
24 - 48	5 (22%)	2 (15%)	3 (30%)
48 - 72	4 (17%)	3 (23%)	1 (10%)
72 - 96	4 (17%)	3 (23%)	1 (10%)
96 - 120	2 (8%)	1 (7%)	1 (10%)
120 - 144	0	0	1
Blood pressures			
Normal (90-140 mm Hg systolic)	62 (95%)	32 (97%)	30 (94%)
> 140 systolic	3 (5%)	1 (3%)	2 (6%)
Code			
Yes	0	0	0
No	65 (100%)	33 (100%)	32 (100%)
Temperature			
Normal	65 (100%)	33 (100%)	32 (100%)
Missing data	0	0	0

Table 22 (Continued)

Variables of Comparison	All	Male	Female
Provider Therapy Variables			
Consultants on ward			
None	63 (96%)	33 (100%)	30 (94%)
Pulmonologist	1 (2%)	0	1 (3%)
Nephrologist	1 (2%)	0	1 (3%)
Medications preoperative vs. postoperative	N / %		
Beta-blockers pre	39 (60%)	24 (73%)	15 (47%)
Beta blockers post	48 (74%)	26 (79%)	22 (69%)
ACE inhibitors pre	23 (35%)	11 (33%)	12 (38%)
ACE post	11 (17%)	5 (15%)	6 (19%)
Lipid lowering agents pre	31 (48%)	15 (42%)	16 (50%)
Lipid lowering post	22 (34%)	9 (27%)	13 (40%)
Calcium channel blockers pre	21 (32%)	9 (27%)	11 (34%)
Calcium channel blockers post	18 (28%)	8 (24%)	10 (31%)
Analgesics pre	5 (8%)	2 (6%)	3 (9%)
Analgesics post	62 (95%)	30 (91%)	21 (100%)
H_2 blockers pre	5 (8%)	1 (3%)	4 (13%)
H_2 blockers post	10 (15%)	4 (12%)	6 (19%)
Proton pump inhibitor pre	6 (9%)	1 (3%)	5 (16%)
Proton pump inhibitor post	8 (12%)	4 (12%)	4 (13%)
Diuretics pre	22 (34%)	7 (21%)	15 (47%)
Diuretics post	44 (68%)	25 (76%)	19 (59%)
Antibiotics pre	2 (3%)	1 (3%)	1 (3%)
Antibiotics post	5 (8%)	3 (9%)	2 (6%)

Table 22 (Continued)

Variables of Comparison	All	Male	Female
Medications preoperative vs. postoperative	N / %		
Inhaler (s) pre	8 (12%)	4 (12%)	4 (13%)
Inhaler (s) post	9 (14%)	6 (18%)	3 (9%)
Herbal (s) pre	3 (5%)	2 (6%)	1 (3%)
Herbal (s) post	0	0	0
Multi-vitamins pre	16 (25%)	6 (18%)	10 (31%)
Multi-vitamins post	4 (6%)	1 (3%)	3 (13%)
Iron pre	3 (5%)	0	3 (9%)
Iron post	20 (31%)	9 (27%)	11 (34%)
Antithrombotic pre	41 (63%)	24 (73%)	17 (53%)
Antithrombotic post	62 (95%)	31 (94%)	31 (97%)
Oral agent for diabetes pre	12 (18%)	5 (15%)	7 (22%)
Oral agent for diabetes post	11 (17%)	5 (15%)	6 (19%)
Insulin pre	3 (5%)	0	3 (9%)
Insulin post	3 (5%)	1 (3%)	2 (6%)
Nitrate pre	36 (55%)	18 (55%)	18 (56%)
Nitrate post	2 (3%)	0	2 (6%)
Inotrope pre	10 (15%)	2 (6%)	8 (25%)
Inotrope post	22 (34%)	13 (39%)	9 (28%)
Antiarrhythmic pre	3 (5%)	0	3 (9%)
Antiarrhythmic post	23 (35%)	15 (46%)	8 (25%)
Hormone replacement pre	18 (28%)	1 (3%)	17 (53%)
Hormone replacement post	10 (15%)	0	10 (31%)
Alpha II blocker pre	4 (6%)	3 (9%)	1 (3%)
Alpha II blocker post	1 (2%)	1 (3%)	0

Table 22 (Continued)

Variables of Comparison	All	Male	Female
Medications preoperative vs. postoperative	N / %		
Thyroid pre	10 (15%)	1 (3%)	9 (28%)
Thyroid post	6 (9%)	0	6 (19%)
SSRI pre	5 (8%)	1 (3%)	4 (13%)
SSRI post	4 (6%)	2 (6%)	2 (6)
Time and Functional Variables			
Ward LOS in days			
Mean (SE)	2.2 (4.3)	2.1 (6.7)	2.25 (5.8)
Median	1.8	1.7	1.9
Range	.7-8.0	.8-8.0	.7-6.0
HLOS in days			
Mean (SE)	6.4 (.46)	6.2 (.5)	6.5 (.46)
Median	6	6	6
Range	3-15	3-15	3-15
Survival to hospital discharge	65 (100%)	33 (100%)	32 (100%)
Discharge destination			
Home	57 (88%)	30 (91%)	27 (84%)
Home health to follow	2 (3%)	0	2 (6%)
SNF	3 (5%)	2 (6%)	1 (3%)
Hospital rehab	2 (3%)	1 (3%)	1 (3%)
Child's home	1 (2%)	0	1 (3%)

note that more of the older subjects were discharged to a location other than their home for recovery (nursing home, skilled care, child's home or rehabilitation, p= .388).

having a second reoperation (none in the total sample). All three had hypertension (62% had in the total sample and two of the three had diabetes (25% in the total sample).

In the CICU, all subjects returned from OR with a Nitroglycerin drip IV, one subject was placed on Nipride for control of hypertension, and two subjects were placed on dopamine for "renal protection". These drips are comparable to subjects in the CABG and OPCAB sample (see Table 15).

CLOS for the MIDCAB (47.25 hours) was most comparable to the OPCAB subjects (47.82 hours). Floor LOS was more comparable between the MIDCAB subjects (47.05 hours) and the OPCAB subjects (47.7 hours) than the CABG subjects (56.02 hours). HLOS for the MIDCAB (4.67 days, SE 1.2) was shorter compared to the CABG (7.0 days, .52 SE) and OPCAB (5.7 days, SE .38) subjects.

Table 23

MIDCAB Descriptive Data

	Total sample N=3	Male	Female
Demographic Variables			
Age	Mean age 70.3 Minimum age 66 Maximum age 73		
Gender		1 (33%)	2 (66%)
Marital status		1 (33%)	2 (66%)
Race, Caucasian		1 (33%)	2 (66%)
Functional and Comorbidity Variables			
Preexisting comorbidities			
Angioplasty		1 (33%)	0
Atrial fibrillation, recurrent		0	1 (33%)
CABG		1 (33%)	2 (66%)
Arthritis		0	1 (33%)
Asthma		0	1 (33%)
Breast cancer		0	1 (33%)
Depression		0	1 (33%)
Diabetes - insulin treatment		0	1 (33%)
Diabetes - oral agent treatment		0	1 (33%)
Hyperlipidemia		1 (33%)	0
Hypertension		1 (33%)	2 (66%)
MI		0	1 (33%)
UTI history		0	1 (33%)

Table 23 (Continued)

	Total sample N=3	Male	Female
Time and Functional Variables			
CLOS in hours			
Mean	47.25		
Ward LOS in hours			
Mean	47.05		
HLOS in days			
Mean (SE)	4.67 (1.2)		

CHAPTER 5: DISCUSSION

The discussion in this chapter is organized based on preoperative characteristics of the total sample and then the surgery, age and gender groups. Subsequently, the surgery, age and gender groups are discussed based on the time periods during the study: preoperative, intraoperative, CICU and ward. Within the surgery, age and gender headings the following variable categories are presented: demographic, physiological, provider therapy and time and functional. Finally, a summary, implications and future research directions will be addressed.

Preoperative Period

Total Sample

Demographic findings.

The majority of the total sample was married and Caucasian. Approximately half (51%) were male and half (49%) were female. All of the subjects lived in their own home or apartment. This is typical of the population served at the Medical Center where this study was conducted. (PATS query from1998-2000, performed 5/17/02).

Functional and comorbidity variables.

The majority of the sample had a normal cardiac rhythm, no history of chronic pain and an average 2.5 comorbidities. Hyperlipidemia and hypertension (HTN) were the most common comorbidities. These are two comorbidities frequently cited as primary risk factors by several other research groups examining OHS patient outcomes (Gardner, et al, 2001; Edwards, Carey, Grover, Bero, & Hartz, 1998), 25% (n=16) of the subjects had diabetes which was treated with an oral agent or insulin. This finding among this study sample is consistent with that of Bhan, et al (1991) who found that the

incidence of diabetes in OHS patients is 6-54%. Cardiac RiskMaster scores for mortality risk had a mean value of 3.6%. The majority of the total sample did not have a history of a previous MI, smoking or regular alcohol use. The days since contrast exposure varied widely (0 to 92 days). The fact that some subjects waited over three months between coronary artery and function testing and OHS may represent a time period in which medical therapy failed.

Physiological findings.

Most of the total sample had a normal blood pressure (90-140 mm Hg systolic), ejection fraction (60% or greater), and NYHA class (0 to Class I). A minority had a cardiac intervention (n= 13) and/or CABG (n = 4) in the past. A surprising number of subjects did not meet the 40.0 d/L lower limit for a normal hematocrit. It was surprising to note that there was no allowance made by the Medical Center laboratory for normal hematocrit range. Mosby's Medical, Nursing and Allied Health Dictionary (1998) reports that a normal range for men is 43-49% and a normal range for women is 37-43%.

Provider therapy findings.

The majority of the sample took beta-blockers (60%), aspirin (63%) and nitrates (55%) during the preoperative period. This finding is consistent with that of Weightman, Gibbs, Sheminant, Whitford, Mahon, & Newman (1999) who studied adult CABG patients.

Surgery Groups (CABG and OPCAB)

Demographic findings.

The two surgery groups were almost identical to each other in terms of demographic characteristics. This is useful for research purposes because differences in

outcomes (recovery variables) cannot be attributed to differences in demographic characteristics. The marital status and race ethnicity characteristics were very similar to the OHS population at the Medical Center. Between 1998-2000, 75% of all OHS were married and 89.5% were Caucasian (PATS analysis by M. Tisdell 5/17/02). Women constituted 32% of the OHS population between 1998-2000 (PATS analysis by M. Tisdell 5/17/02). Gender in this study was dissimilar to the total OHS population at the Medical Center due to deliberate gender matching. There were no statistically or clinically significant differences between the two surgery groups based on demographic variables.

Functional and comorbidity findings.

Within the functional and comorbidity category, there were no statistically significant differences between the two surgery groups. It was clinically interesting to note that the OPCAB group had more history of chronic pain (p= .044). The OPCAB literature reviewed did not address history of chronic pain. The OPCAB subject group had higher Cardiac RiskMaster scores (indicates higher risk) in all four categories: death, near-miss (morbidity), transfusion and stroke. The notion that OPCAB surgery is preferable for patients with higher risk scores is supported by the research of Bittner, Savitt, McKeown & Lucke (2001) and Hart (2000). Bittner, et al researched a sample of 14 patients who had high-risk scores (23 + or B 4) based on a risk model similar to Cardiac RiskMaster (Parsonnet) and there was no mortality in the group. One patient did have to be converted to cardio-pulmonary bypass and one patient did have a stroke in the hospital. An average of 2.3 bypasses were done in this study of OPCAB patients. At

one-year follow-up, none of the patients had angina and all had survived. HLOS was not reported. Hart (2000) performed OPCAB procedures on 226 patients who were high risk (not defined using a risk scoring system). One of the patients required dialysis, 5 required ventilator support more than 24 hours and one had a postoperative stroke. All patients survived to discharge from the hospital where the study was performed. In the present study, all subjects also survived to discharge from the hospital as well.

Provider therapy findings.

During the preoperative time period, provider therapy included preoperative medications. There were no statistically or clinically significant differences between the surgical groups. This helps assure that the groups were very similar based on the defined preoperative variables.

Age Groups (Young-Old and Old)

Demographic findings.

The major difference among the demographic variables among the age groups was that more of the old women were widowed.

Functional and comorbidity findings.

With respect to risk, in the current study there was one statistically significant difference: the old (75-86 year old) group had a higher risk for transfusion than the young-old (67-74) ($p = .004$). This finding is consistent with the research of Karkouti, Cohen, McCluskey & Sher (2001). They found that of the 1007 adult patients who had a CABG, 29.4% required blood transfusion. Using logistic regression they examined patient demographics, comorbidities and preoperative hemoglobin and determined that preoperative hemoglobin, weight, age and gender (in that order) were the best predictors

of blood use. This rule had an 82.1 percent level of sensitivity and 63.6 percent level of specificity. These findings should be tested in other OHS groups before generalizing. In the current study, risk of transfusion was not compared to whether or not a transfusion was received.

In addition to transfusion risk findings, several findings between age groups were clinically significant. In research done by Hirose, Amano & Takahashi (2001), surgical risk increased with increased age. Their findings indicated that after age 75 risks for CABG surgery are significantly increased, but once surgery is completed the cardiac events after surgery can be controlled as effectively as for younger patients. Such control was reflected in the outcomes of the current research sample who discharged from the Medical Center in a timeframe similar to the young-old group.

Within the current study, EF% was higher in the old group compared to the young-old ($p= .034$). When examining the distribution within the age groups, there were several older patients who had EF % in the 70 and 80% ranges. While no scientific hardiness or resilience literature was located which examined EF% as a measure of survival, it was not surprising to find several women who had EF% in the above normal range. Based on clinical experience at this Medical Center, it is not uncommon to meet old women who are very active in performing strenuous yard work or who exercise regularly. These activities may contribute to their overall cardiac function.

The other clinically significant finding was that more of the old group had HTN than the young-old ($p= .060$). Hypertension has been identified as a contributing factor to the development of coronary heart disease and the incidence of hypertension increases as American age (Williams, et al, 2002). Hyperlipidemia and diabetes are also

recognized as significant risk factors for the development of coronary artery disease. However, the age groups in this sample did not vary based on these comorbidities.

Physiological findings.

The two age groups were comparable on all physiological variables except that the older groups had more subjects with a higher EF% and less Class IV heart failure than the younger group. This may represent a selection bias on the part of the surgeons, who may be avoid providing this revascularization option to those over 74 years of age who have decreased cardiac function overall (indicated by reduced EF% and Class IV heart failure).

Provider therapy findings.

There were statistically or clinically significant differences in provider therapy variables (medication) between the age groups. While more of the old received beta-blockers, lipid lowering agents, diuretics and aspirin overall, this did not translate into significant group differences based on age. Within the other categories of medications, the age groups received medications in very comparable numbers.

Gender Groups (Male and Female)

Demographic findings.

Statistically significant differences between the male and female groups included: marital status was different, based in large part of the fact that more women were widowed (p= .002). Difference in marital status was not surprising since it is generally understood in American culture that women live longer than men.

Functional and Comorbidity Findings

Transfusion risk was greater for females than males (p= .003). Since Cardiac

RiskMaster uses hematocrit to calculate transfusion risk, the lack of gender-specific ranges probably contributes to this increased estimated risk. Transfusion as a risk factor of greater significance for women than men has been identified by other researchers in the CABG population (Shevde, et al, 2000). This finding is also consistent with that of Koch, et al (1996). He found that transfusion risk for adult women who had a CABG procedure was significantly higher than for men (p= .001). No literature addressing transfusion risk was found for the OPCAB population.

Clinically significant findings were a) females were more likely to have a higher near-miss score with Cardiac RiskMaster (p= .040), b) females had higher Cardiac RiskMaster scores for stroke (p= .033). Females more often had a diagnosis of hyperlipidemia (p= .034) and peripheral vascular disease (PVD) (p= .022). These findings for higher risk (with or without a score) are consistent with the observations of another groups of researchers (Williams, Chaudhri, Morales, Helman & Oz, 2000). They concluded that females with small body size and higher age had higher risk for morbidity and mortality after OHS and had more co-morbidity (including PVD) when surgery was performed. There are multiple reasons why women are thought to have higher risk when presenting to the health care system for OHS. They present when they are older and tend to have more comorbidities. Typical comorbidities found at a higher rate with women are: HTN, diabetes, CHF, and angina (Weintraub, Wenger, Jones, Craver, & Guyton, 1993). I n this sample, hyperlipidemia and PVD occurred with greater frequency among females (p 0.034; p= 0.022). This finding is consistent with that of King (2000) and Williams, Chaudhri, David, Morales, Helman, & Mehmet. (2000). Within her sample of 120 adult CABG patients, King (2000) found that 49% of the females in her sample had

diagnosed hyperlipidemia compared to 34% of the men. Williams, et al (2000) of the 19,224 patients who had coronary artery bypasses in New York State in 1995, PVD occurred more frequently in females than males ($p < .001$).

There were no clinical or statistically significant differences within gender groups for the other comorbidities assessed: COPD, HTN, chronic renal failure, chronic renal depression, pulmonary edema history, cerebral events, sudden death history, and urinary tract infection (UTI) history. In contrast, other researchers have found that women have more HTN than men in adult CABG groups (Aldea, et al, 1999).

Physiological findings.

During the preoperative period there were no statistical or clinical differences in physiological variables between gender groups.

Provider Therapy Findings

Females were prescribed HRT ($p = .000$) and thyroid ($p = .000$) more frequently than males prior to admission to the Medical Center. In addition, males were more likely to have beta-blockers prescribed ($p = .033$) and females were more likely to have inotropes ($p = .034$) and diuretics prescribed ($p = .029$). This latter finding was unique among the scientific literature examined.

Intraoperative Period

Surgery Groups

Physiological findings.

There were several statistically significant differences among the physiological and provider therapy variables during the intraoperative period. The CABG subjects had more urine output than their OPCAB counterparts ($p = .000$). This finding was not

surprising given the report of two of the surgeons (Drs. Douville & Handy, verbal communication, 5/6/02) who performed the operations on these subjects. While CABG patients are on cardiopulmonary bypass, they are routinely given intravenous mannitol, which usually has a profound diuretic effect. Because of this diuresis, this researcher wondered if serum potassium levels in the CICU would be different between the CABG and OPCAB groups. They were neither statistically or clinically different.

Provider therapy findings.

The number of grafts was greater in the CABG subject group than the OPCAB subject group (p= 0.001). This finding is consistent that of with a two-year, three institution study of the CABG and OPCAB samples performed by Spooner, Hart, and Pym (1999). In that study, adult CABG patients had a mean of 3.0 bypasses and adult OPCAB subjects had 1.9 bypasses.

Anesthesia time (p= .004) and surgical time (p= .000) in the current study were greater for the CABG subjects compared to the OPCAB subjects. This finding was not a surprise because of the additional time required to cannulate the aorta and go on and come off bypass for the CABG subjects. There were no other notable findings for the surgery groups during the intraoperative period.

Time and functional findings.

During the intraoperative period there were no statistical or clinical differences in time and functional variables between surgery groups. No literature was found that discussed this finding.

Age Groups

Physiological findings.

During the intraoperative period there were no statistical or clinical differences in physiological variables between age groups. No literature was found that discussed this finding.

Provider Therapy Findings

The young-old received more crystalloid during surgery than their old counterparts (p= .005). No literature-based support for difference this was located. This researcher believes this may reflect a bias on the part of the anesthesiologists who administer fluids during the OHS cases. They may more tightly control the amount of fluids a patient 75 years and older receives. If this belief exists it may not necessarily reflect the ability of subjects in the old group to "handle" fluid (better EF% overall) or the desire of the surgeons to fluid restrict these patients to the greatest extent safely possible.

Time and functional findings.

Age groups did not vary statistically or clinically with regard to physiological variables during the intraoperative period. There was no intraoperative morbidity or mortality in this study. Some previous research demonstrated higher mortality and morbidity among the elderly (60 and older) having a CABG or OPCAB during the intraoperative period (Baumgartner, Yokoyama, Gheissari, Capouya, Panagiotides and Declusin, 2000).

Gender Groups

Physiological findings.

There were no statistically or clinically significant differences in physiological variables between gender groups during the intraoperative period. No literature was found that discussed this finding.

Provider therapy findings.

In contrast to other research findings, it was interesting to note that females (whether in the CABG or OPCAB surgery group) in this sample did not receive more grafts, have longer OR and cardiopulmonary bypass time or require more transfusions than their male counterparts. No literature was found that discussed this finding.

Time and Functional Findings

There were no statistically or clinically significant differences in time and functional variables between gender groups during the intraoperative period. A study by Ott, et al (2001) of 351 men and 160 women examined gender-related findings in adult patient recovery after CABG surgery. These researchers found that while the preoperative risk was higher for the women (largely attributed to their increased age at the time of surgery) that they did not suffer more morbidity or mortality and discharged within a comparable timeframe to their male counterparts.

CICU Period

Surgery Groups

Physiological findings.

Within the subjects' physiological differences, there were no statistically significant findings. There were several items with clinical significance. The total

(Blake, bulb and/or chest tubes) blood output was greater for the CABG subjects compared to the OPCAB subjects (p= .018). This is consistent with other researchers' findings that that CABG subjects had more blood output overall (Demers & Cartier, 2001). The CABG subjects also had more urine output (p= .053) overall, which is likely due in part to the intravenous mannitol that is given during surgery. There were no other diuretics given routinely to these patients in CICU and they had comparable EF%'s, cardiac index and PCWP (all measures of cardiac function) and serum creatinine levels. The fact that subjects' serum potassium levels were not statistically or clinically different was judged a marker for how aggressively and effectively the potassium levels were managed by the CICU RN's after surgery.

Provider therapy findings.

There were no significant differences between the surgery groups among the CICU provider therapy variables. However, the clinically significant findings were that the CABG patients required more RBC transfusions postoperatively than the OPCAB subjects (p= .027). This finding is not surprising given that CABG patients had more total blood output. This finding is consistent with a report by Connerney, et al published in 2000. These researchers found that only 13% of the OPCAB patients required blood transfusion compared to 27% of the CABG patients (sample size not reported). It was surprising to note that vasoactive IV medication use was not statistically or clinically different between surgery groups. Clinical beliefs held by health care professionals caring for both populations at the Medical Center have been that OPCAB patients receive less vasoactive medications. The current study demonstrates that this belief was unfounded, at least among patients aged 65 and older.

Time and functional findings.

Time and functional comparisons between surgery groups within the CICU had several statistically and clinically significant findings. From a statistically significant perspective, OPCAB subjects had higher GCS scores when they were first assessed in the CICU (p= .001). This finding is consistent with the researcher's clinical observation that these patients return from OR more awake and responsive than their CABG counterparts. OPCAB subjects had their bulb (leg) drains removed sooner than the CABG subjects. This is likely related to the fact that they tend to transfer to the ward a few hours sooner than the CABG subjects. The clinically significant findings were that the CABG subjects took longer to be extubated than the OPCAB subjects (p= .060). This corresponds to the finding that the OPCAB patients had higher GCS scores (were more awake and responsive) upon return to CICU. Also, the CABG patients received more 1:1 nursing care than the OPCAB patients (p= .061). This was not surprising given that more of the OPCAB subjects came form OR extubated and those who were still intubated upon admission to CICU were extubated sooner. All these factors increase the requirements for more intensive levels of nursing care.

While statistically or clinically significant levels were not reached, it was of interest to note that there were 7 CABG and 4 OPCAB subjects who exhibited behavior consistent with delirium during the CICU and ward stay. Additional exploration of the influence of circadian rhythms, arrival time from OR, sleep patterns during the OHS hospitalization and the sameness or differences in medication therapy received may be warranted. In a study done by Rolfson, et al (1999) the rate of post OHS delirium in 71 CABG subjects who were 65 years and older was 32%. These researchers found that

those who developed delirium were more likely to have had a stroke, had longer cardiopulmonary bypass times and tended to have a lower cardiac output postoperatively. Additional analysis of data from the current study could be performed to explore these relationships in this study sample.

Age Groups

Physiological findings

There were no physiological differences between the age groups that reached statistical significance during the CICU stay. In a study 117 CABG and 86 OPCAB patients performed by Kirk, et al., (2001) it was demonstrated that OPCAB patients required fewer transfusions, which implies a lower hematocrit, but other physiological variables consistent with this study were not reported.

Provider therapy findings.

There was one statistically significant difference between age groups in the CICU provider therapy variables. On POD 3 the young-old received a more morphine equivalents than the old ($p = .005$). While there was no scientific literature located that addressed this finding, it may represent a health care professional tendency to medicate the young-old more than the old. Over the course of this researcher's career the comment that someone is too old to tolerate much pain medication has often been heard. Celia (2000) studied 382 adult patients' pain for three days after CABG surgery. Her conclusions support the finding in the current study that older patients (in her case, >60 years) received less pain medications than patients who are younger.

It was interesting to note that there were no age group differences in the amount of blood products received or the amount of vasoactive medications used. This is an

important finding to share with the researcher's nurse colleagues who sometimes express belief that old people don't tolerate any medication as well as younger people.

Time and functional findings.

While there were no statistically significant findings between the age groups among the time and functional variables in the CICU, there were several that were clinically significant. First the CLOS (CICU LOS) was longer for the old compared to the young-old (p= .053). This may represent a clinical belief that we should not move the old out of CICU as quickly, or that there is a clinician-initiated triaging which occurs when several patients are moving out of the unit in a day. Clinicians may tend to keep someone 75 years or older a few hours longer to make sure their blood pressure is stable or that they don't become symptomatic after tubes and lines are discontinued. Several researchers have noted longer ICU LOS for those over 65, but their research did not use the same age groupings used in this study (Nickerson, Murphy, Davila-Roman, Schechtman, & Kouchoukos, 1999).

Extubation also occurred sooner for the young-old compared to the old group (p= .057). Several of the types of tubes and lines were discontinued sooner in the young-old: arterial (p= .048), pulmonary artery (PA) (p= .034) and the catheter that drains urine (p= .061). All these findings are consistent with the shorter CLOS for the young-old and the tendency of the health care professional to watch the old "just a little bit longer" to make sure they are progressing toward expected outcomes and discharge. While 1:1 nursing care time was not statistically or clinically different for the age groups, the presence of hemodynamic lines (arterial or pulmonary artery) and longer length of stay in the CICU for old subjects was. A longer stay in the CICU does allow closer observation. Once the

subjects were transferred to the ward the nurse-patient ratio would increase to 1:3 – 1:5. Patients on the ward are also spread across a larger geographic area (rooms are 50 –100 feet apart) making frequent visualization and hands-on care less frequent.

Gender Groups

Physiological findings.

There were no statistically or clinically significant findings for physiological variables between the gender groups in this study. This is counter to research reported by Ott, et al. (2000). They found females more likely to die, develop morbidity, require reoperation, require postoperative IABP support or suffer respiratory or renal failure postoperatively. All of these variables were measured in the current study and none of the subjects died.

Provider therapy findings.

Among the provider therapy findings there were several variables that reached statistical significance. Males were more likely than females to receive more morphine sulfate equivalents on POD 2 (p= 007). This finding is consistent with that of Nelson, Zimmerman, Barnason, Nieveen, & Schmaderer (1998). In Nelson study's study of 86 adult CABG patients (mean age 66 years) there was a significant interaction between pain and anxiety that was greatest for men on POD 2 ($p < .01$). In the current study, females were more likely to receive more morphine sulfate equivalents on POD 7 (p= .001). Factors which potentially influence this dosage variation could include postoperative medication prescription (unlikely given the standardized post OHS order set), provider beliefs about subject pain and treatment of same, females may have fewer mu receptors essential for morphine action or subject willingness/ability to report pain

and/or request pain medication (Miller & Ernst, 2001). While no scientific literature was located that discussed this variation in dosing over the entire course of hospital stay, it is important to note that by POD 7 the majority of the subjects had discharged, leaving fewer to reach this conclusion. A larger sample size overall would help in determining whether this finding could be true in the elderly OHS population overall. Celia (2000) reported in her study of 382 CABG patients for three days postoperative that men and patients who had fewer complications received more pain medication. Celia's subjects used patient controlled analgesia (PCA) which allows patients to self-administer pain medication through an intravenous line (within dosage limits established by a physician). When Celia applied ANCOVA to control for the amount of pain medication administered per patient request, patients with complications received more pain medication/request than those without complications. One of Celia's conclusions was that nurses may undermedicate patients even though sufficient pain medication was prescribed (98% of her subjects received only 28% of what was prescribed). The current study also found that men receive more morphine equivalents on POD 2. Subjects in the current study did not use PCA's. This researcher attempted to control for LOS while examining findings in morphine equivalents between genders. However, sample size was not adequate for this analysis.

Within the provider therapy variable group in CICU, it was very interesting to note that use of vasoactive medications did not vary based on gender. This researcher has not located any studies published that discuss this finding.

Time and functional findings.

There were no statistically or clinically significant differences among the time

and functional variables between the gender groups. No scientific literature was located which addressed these variables.

Ward Period

Surgery Groups

Physiological findings.

During the ward period there were no statistical or clinical differences in physiological variables between surgery groups. No literature was found that discussed this finding.

It was surprising that none of the 65 subjects developed a fever during the ward stay. Fever as a complication does not occur frequently, but this researcher expected that odds would be that one or two of these subjects would develop a fever during their stay.

Time and functional findings.

The HLOS was longer for the CABG subjects than the OPCAB subjects and did reach a clinically significant level ($p= 0.052$). This finding is consistent with those of Turner (1999) and Iaco, Continit, & Teodori, et. al. (1999). In Turner's (1999) study, OPCAB subjects had a mean LOS of 4.4 days compared to CABG subjects who stayed an average of 6.6 days. Iaco et al's study (1999) OPCAB subjects stayed an average of 4.0 days, with the CABG patients staying 6.6 days. It is important to note that subjects in both studies were adult, but were not necessarily elderly. The 30-day mortality in Turner's (1999) study was 3% and 30 day mortality in Iaco et al (1999) study was 1.9%. In this study, all subjects survived to discharge from the Medical Center and 30-day mortality was not measured.

Time and functional findings.

The HLOS was longer for the CABG subjects than the OPCAB subjects and did reach a clinically significant level (p= 0.052). This finding is consistent with those of Turner (1999) and Iaco, Continit, & Teodori, et al (1999). In this study, all subjects survived to discharge from the Medical Center.

Age Groups

Physiological findings.

During the ward period there were no statistical or clinical differences in physiological variables between age groups. No literature was found that discussed this finding.

Time and functional findings.

During the ward period there were no statistical or clinical differences in time and functional variables between age groups. No literature was found that discussed this finding.

It was not surprising to note that while no statistically or clinically significant differences were found, numerically more of the old went to a discharge location other than their own home compared to the young-old (p= .149).

Time and functional findings.

During the ward period there were no statistical or clinical differences in time and functional variables between age groups. No literature was found that discussed this finding.

It was not surprising to note that while no statistically or clinically significant findings were reached, more of the old went to a discharge location other than their own

home compared to the young-old (p= .149).

Gender Groups

Physiological findings.

During the ward period there were no statistical or clinical differences in physiological variables between gender groups. No literature was found that discussed this finding.

Provider therapy findings.

More women in the current study were discharged on hormone replacement therapy (HRT) (p= .000) and more women took thyroid than their male counterparts (p= .005). This was expected based on this researcher's clinical observation that a substantial number of women admitted to the CICU at this Medical Center report taking these medications. There is a debate in the literature regarding whether or not HRT medications have a cardioprotective effect in women (Tamis-Holland & James, 2001; Schwarzenberger, 2001). The literature does not report conclusive reasons why women are on more thyroid replacement.

Time and functional findings.

During the ward period there were no statistical or clinical differences in time and functional variables between gender groups. No literature was found that discussed this finding.

Important, Unique and Surprising Features of Research

The most personally surprising finding to this researcher was lack of statistical or clinically significant findings based on age. Given the frequent reference to increased risk over age 70 or 75 in the literature, this researcher expected to see more untoward

outcomes in the old group. It was of particular interest to note that some of the old women had the highest EF%'s and that the old group's HLOS was very comparable to their younger counterparts.

Alternative Interpretations

Surgeon selection of elderly patients for OHS is sometimes focused on relief on angina instead of prolongation of life (E.C. Douville, verbal communication, 5/10/02). Because all the subjects in this sample survived to discharge, surgeon clinical assessment and selection of elders may be refined to a point where less risk for individuals is present than was predicted by Cardiac RiskMaster. Based on Cardiac RiskMaster data alone, more morbidity and some mortality would be anticipated.

Clinical Issues

One of the clearest "learnings" to this researcher was the variation in pain medication administration among providers: physician prescriptions and nurse administration and documentation. (This researcher noted this as she performed chart reviews and data analysis). If pain rating of the subjects' had been collected it could have been examined in combination with pain medication administration and a more significant conclusion about why wide variation in medication might have been possible. Research literature is with examples of physicians' tendency to underprescribe pain medication and nurses' tendency to undermedicate the elderly Bostrom, Ramberg, Davis, & Fridlund, B., 1997; Jamison, et al, 1997; Whipple, et al, 1995).

Within this study there are multiple variables that cannot be influenced by nurses. Patients are admitted to the Medical Center with medication prescriptions provided by their primary care provider and they come with pre-existing comorbidity. What nurses

can influence is the physiological variables that are influenced by vasoactive (and other) medications, activity and mobility progression and effective discharge planning (i.e. will the environment and significant others be able to help them progress toward their recovery goals).

Limitations and Future Directions

Because the OPCAB patient population has not been researched extensively in medicine and to an even lesser extent in nursing, it was important to explore how these patients were similar and different from their CABG counterparts. This comparison was performed in as inclusive a manner as possible for the preoperative and complete hospital stay (intraoperative, CICU and ward). This scope of research on the two surgery groups is unique in any health care literature found. The exploration and comparison done in this research provide an essential foundation for the additional scientific steps possible, but should not be generalized beyond this sample. This research represents the first step in understanding and comparing recovery of elders who have a CABG or OPCAB procedure. Additional steps could include: prospective research, hypothesis testing, or intervention within a hospital setting; or research which examines the longer-term recovery of elders who had CABG or OPCAB procedures. This researcher is particularly interested in first exploring the delirium and pain management practices among the surgery groups and the QOL after hospital discharge.

Summary and Implications

Acute care nurses care for several types of elderly (>64 years) OHS patients: CABG and OPCAB. Review of literature included studies in nursing and other health care disciplines, which examined some recovery outcomes for the CABG population.

However, the OPCAB procedure has been widely used recently and there is very little health care research addressing this population. A conceptual framework was developed to demonstrate how variable categories within each of the four time periods of data collection (preoperative, intraoperative, CICU and ward) influenced the recovery outcomes of these elderly subjects. A descriptive, comparative method was used to retrospectively to examine how gender and age-matched pairs of elderly subjects recovered from these surgical procedures. Data were collected from the preoperative, intraoperative, CICU and ward time periods for 65 subjects (mean age of 75.3 years, SE .5). More than 200 data points were collected about each subject. These variables were categorized into demographic, physiological, time and functional and provider therapy groups.

Data were entered into SPSS version 10.0 and analyzed using descriptive statistics, t-tests, chi square and Fisher's exact. Statistical significance was originally set at p= .05, but was raised to p= .01 because of the large number of comparisons that were made. Clinical significance was set at p= >.01 - .065. While this study does provide a complete look at the preoperative through ward stay of a group of subjects at one NW Medical Center, no hypothesis testing was done. Therefore, generalization is not possible and future research is certainly warranted.

Results highlights include: a) CABG patients received more grafts (p= .001), b) had lower Glascow Coma Scores on admission to CICU (p= .001), c) had more blood output (p= .018), and d) stayed longer in the hospital (p= .052) than their OPCAB counterparts. The old subjects received less crystalloid during the intraoperative period (p= .005) and while their Cardiac RiskMaster scores were higher than for the young-old

(p= .004), the two age groups did not vary based on transfusions received (p= .683). Invasive lines in CICU stayed in a clinically significantly longer period for the old. Males received more beta-blockers during the preoperative time period (p= .033), while females received more diuretics (p= .029), hormone replacement therapy (p= .000), inotropes (p= .034), and thyroid replacement (p= .005). While females had higher preoperative Cardiac RiskMaster scores in the near-miss (p= .040), transfusion (p= .003), and stroke (p= .033) categories, they did not have higher incidence of these untoward outcomes than their male counterparts. Males received more morphine equivalencies for pain relief on postoperative day two (p= .007), which is consistent with other research. There were 11 case (17%) of postoperative delirium. While this finding did not reach defined statistical or clinical significance levels, it did occur in both surgery groups (7 CABG and 4 OPCAB), more in the old than the young-old and more in the women than men.

This is the first study to examine multiple recovery variables throughout the course of hospitalization for elderly CABG and OPCAB patients. It provides descriptive and comparative data that will enable nurses to anticipate and respond to elders of various ages recovering from CABG and OPCAB surgeries.

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APPENDIX A

Preadmission Data Collection Form (PDCF)

STUDY ID NO. _____

PREADMISSION DATA COLLECTION FORM (PDCF)

PREOPERATIVE VARIABLES

Demographic Variables

1. Age _____

2. Sex:
   1. Male _____
   2. Female _____

3. Race:
   1. African-American _____
   2. Caucasian _____
   3. Hispanic _____
   4. Asian _____
   5. Middle-Eastern Caucasian _____
   6. Other _____

4. Marital Status:
   1. Married _____
   2. Single _____
   3. Divorced _____
   4. Separated _____
   5. Widowed _____
   6. Co-habitate _____

Physiological Variables

5. BP category S-_____ D-_____

6. BMI: Height _____ inches
   Weight _____ lbs. _____Kg.

7. EF % _____
   Date _____

8. Laboratory Values: Date _____
   H/H: _____ Mg: _____
   K^+: _____ Alb: _____
   Ca^+: _____ : _____
   : _____
   : _____

Functional & Co-morbidity Variables

9. History of arrhythmias Yes _____ No _____
   Type: _____
   _____

10. History of chronic pain Yes _____ No _____
    Type: _____
    _____

11. Medications: _____
    _____
    _____
    _____
    _____
    _____
    _____
    _____
    _____

12. NYHA Class _____

13. Pain Medication: _____
    _____
    _____

14. Pre-existing Comorbidities:
    _____ _____
    _____ _____
    _____ _____
    _____ _____
    _____ _____
    Risk Score _____

15. Smoking History: _____ pack years
    Smoking now? Yes _____ No _____
    Quit when: _____

16. Time since last contrast medium exposure:
    _____

17. Date of surgery _____

18. Consultants _____
    _____

Notes:

APPENDIX B

Intraoperative Data Collection Form (IDCF)

STUDY ID NO. _____

INTRAOPERATIVE DATA COLLECTION FORM (IDCF)

OPERATING ROOM VARIABLES

Physiological Variables

1. Arrhythmias: Yes _____ No _____
   Type: _____
   Duration: _____

2. BP's - First: _____
   Lowest: _____
   Highest: _____

3. Output - Blake: _____
   Bulb: _____
   Chest Tubes: _____
   NG: _____
   Urine: _____

4. Temperature:
   High _____ Low _____
   Route _____ Route _____

5. Survival to discharge from the OR:
   Yes _____ No _____
   If no, time of death _____

6. Code: Yes _____ No _____
   # of min. (if yes) _____
   # of Defib: _____ I _____ E _____
   Survived: Yes _____ No _____

7. ABG's

Time						
pH						
CO_2						
O_2						
BE						
HCO_3						
FIO_2						

Functional & Co-morbidity Variables

8. Colloid Replacement: Yes _____ No _____
   Type - _____
   Amount _____

9. Crystalloid Replacement: Yes _____ No _____
   Type - _____
   Amount _____

10. Autotx: Yes _____ No _____ Total Vol _____

11. IABP Use: Yes _____ No _____
    Time started _____

12. Medications:
    anesthetics _____
    analgesics _____
    antibiotics _____
    Cardioplegia Solution _____
    Other _____

Time and Functional Variables

13. Surgery Date _____

14. C-P bypass time: _____

15. Time surgery started _____
    Time surgery ended _____

16. Surgical time _____
    Anesthesia time _____

Notes:

APPENDIX C

CICU Data Collection Form (CDCF)

STUDY ID NO. _____
CICU SHEET # ____ OF ____

CICU DATA COLLECTION FORM (CDCF) SHEET I

1. Date and Time Admitted: _____

Physiological Variables

2. Arrhythmias: Yes ____ No ____

Type			
Date			
Duration			
Type			
Date			
Duration			

3. ABG Values:

Date											
Time											
ph											
pCO_2											
paO_2											
BE											
HCO_3											

4. Blood Glucose Values:

Date													
Time													
BS													
CBG													

5. BP's:
First: _____
Lowest: _____
Highest: _____

6. Bowel Function:
Sounds Yes ____ No ____
Date and Time _____

7. Bowel Function:
Stool Yes ____ No ____
Date and Time _____

8. BUN/Creatinine Value

Date													
Time													
BUN													
Cr													

9. H/H Values:

Date													
Time													
Hemoglobin													
Hematocrit													

10. K+ Values:

Date													
Time													
K+													

11. Mg++ Values:

Date													
Time													
Mg++													

12. Ca++ Values:

Date													
Time													
Ca++													

13. Output:

Date													
Time													
Blake													
Bulb													
Cx tube													
NG													
Urine													

14. PA Catheter Values:
Initial S/D _____ Lowest S/D _____ Highest S/D _____

Date													
Time													
CO													
CI													
CVP													
PCWP													
PVR													
SVR													

15. Temperature: Admission ____ Hrs to ≥ 36° C ____

DOS	1	2	3	4	5	6	7	8	9	10
24										
08										
16										

16. Glascow Coma Score:
First _____ Last _____

17. Survival to discharge CICU Yes ____ No ____

18. Code Status : _____
Δ Date/Time _____

19. Code: Yes ____ No ____
# of min. (if yes) _____
# of Defib* _____ I _____ E _____
Survived: Yes ____ No ____

20. Morbidity During Hospitalization:

Condition			
Date ID'd			

Provider Therapy Variables

21. Autotransfusions: Yes ____ No ____
Total Volume _____

22. Colloid Replacement: Yes ____ No ____

Date													
Time													
Type													
Amount													

23. Consultants: Yes ____ No ____
Specialty _____
Date Consulted _____ POD _____
Specialty _____
Date Consulted _____ POD _____
Specialty _____
Date Consulted _____ POD _____

24. Crystalloid Replacement: Yes ____ No ____

Date													
Time													
Type													
Amount													

Notes:

STUDY ID NO. _____
CICU SHEET # _____ OF _____

CICU DATA COLLECTION FORM (CDCF) SHEET II

25. Medications/Dose/Frequency | Start | Stop

26. Transfusions

Date													
Time													
Type													

27. Extubation

Date				
Time				
Total Hours				

Trach Yes _____ No _____
Date, if yes _____
IABP Use Yes _____ No _____ Total Hrs _____ Total Days _____

28. Reintubation Yes _____ No _____
Date, if yes _____

Time and Functional Variables

29. Mobility:

	BR	D	Sit	St	W to C	WiR	Amb
Date							
Time							

30. CICU Length of Stay: (CLOS)
Hours _____
Days _____

31. Time as 1:1 Status:
Hours _____
Days _____

32. Time and Date of CICU Discharge:
_____

33. Time to lines out:

	Date	Time
Arterial		
Central		
PA		

34. Time to tubes out:

	Date	Time
Blake		
Bulb		
Chest Tubes		
NG		
Urine		

35. Time to void spontaneously
Cath Inserted _____
Cath Discontinued _____
Hours to Spontaneously Void _____

Notes:

Notes:

APPENDIX D:

Ward Data Collection Form (WDCF)

STUDY ID NO. _____

WARD DATA COLLECTION FORM (WDCF)

1. Date/Time admitted to ward: _____

Provider Therapy Variables

2. Medications/Dose/Freq. Start Stop

_____ ____ ____
_____ ____ ____
_____ ____ ____
_____ ____ ____
_____ ____ ____
_____ ____ ____
_____ ____ ____
_____ ____ ____
_____ ____ ____

3. Mobility:

	BR	D	Sit	STD	wlc	wlr	amb
Date							
Time							

Physiological Variables

4. Blood Pressure:
   Admission: _____
   Discharge _____

5. Temperature:

24										
08										
16										

6. Arrhythmias: Yes _____ No _____

Type					
Date					
Time					
Type					
Date					
Time					

Time and Functional Variables

2G/2R LOS _____ days

7. H LOS:
   Date Admitted _____
   Date Discharged _____
   Time of Discharge _____
   Discharge Destination _____
   H LOS = _____

8. Survival to Hospital Discharge
   Yes _____ No _____
   If no, date of death _____

9. Code Status _____
   △ Date/Time _____

10. Code: Yes _____ No _____
    # of min. (if yes) _____
    # of Defib: _____ I _____ E _____
    Survived: Yes _____ No _____

11. Morbidity During Hospitalization:

Condition			
Date ID'd			

Notes: