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Opioid and Benzodiazepine Prescription and Administration Patterns in Cardiac Surgery Patients in Intensive Care Units

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Opioid and Benzodiazepine Prescription and Administration Patterns in Cardiac Surgery Patients in Intensive Care Units

Twyila Dawn Lay

Abstract

This study was conducted to determine the effects of age upon the prescribing and administering patterns of health care practitioners of opioids and benzodiazepines in a sample of 80 cardiac surgery patients. The age categories were patients <65 years of age and patients ≥65 years of age. Medical records were reviewed of adult cardiac surgery patients undergoing valve replacements and coronary artery bypass surgery within a single metropolitan teaching hospital. Data were collected for up to three days or until the patient was discharged from the intensive care unit (ICU). For each of the study days, the specific types of opioids and benzodiazepines prescribed and administered were recorded. Calculations were performed to determine the maximum amounts of opioids and benzodiazepines prescribed and administered for the study period. Analysis revealed that age had no impact upon the types and amounts of opioids or benzodiazepines prescribed. There was no statistically significant difference between the amounts of opioids and benzodiazepines administered according to age with one exception. On postoperative day two (POD2) those ≥65 years of age were administered opioid doses that were significantly less than those administered to patients <65 years of age. Although no statistically significant difference was found in prescription versus administration according to age, a significant difference was noted in the doses of opioids and benzodiazepines prescribed versus administered for the total population across all three investigational days. Further

investigations are warranted regarding opioid and benzodiazepine administration compared with patient self reports of pain.

Introduction

Almost half of the patients treated in intensive care units (ICUs) are older than 65 years of age, and a large proportion of ICU cardiac surgery patients are elderly.(Fulmer & Walker, 1990). Specifically, of the more than 800,000 cardiac surgeries performed each year in the United States, 53% are performed in patients over 65 (Graves, 1992; American Heart Association, 1991). Most cardiac surgery patients receive analgesics and sedatives while in ICU, yet little is known about the relationship between the age of the cardiac patient and health care practitioners' prescription and administration patterns. This pattern of drug use includes the amount of drug prescribed and the amount administered over a specific time period. Therefore, the purpose of this study was to investigate opioid and benzodiazepine prescription patterns of physicians and the drug administration patterns of nurses in two groups of cardiac surgery patients (i.e., those less than 65 years of age, and those greater than or equal to 65 years of age). The specific study questions were:

1. Is there a difference in the type and amount of opioids prescribed for patients under the age of 65 compared to patients equal to or greater than 65 years of age?

2. Is there a difference in the type and amount of benzodiazepines prescribed for patients under the age of 65 compared to patients equal to or greater than 65 years of age?

3. Is there a difference in type and amount of opioids administered to patients less than 65 years of age compared to patients equal to or greater than 65 years of age?

4. Is there a difference in type and amount of benzodiazepines administered to patients less than 65 years of age compared to patients equal to or greater than 65 years of age?

5. Is there a difference in the opioid dose prescribed versus administered to patients under the age of 65 compared to patients equal to or older than 65 years of age?

6. Is there a difference in the benzodiazepine dose prescribed versus administered in patients under the age of 65 as compared to patients greater than or equal to 65 years of age?

Literature Review

Pain in ICU Patients

The fear of pain is a major concern for patients during their ICU stays (Jones, Hoggart, Withey, Donhaghue, & Ellis, 1979). This fear may be well founded since at least half of the 23 million patients undergoing surgery each year do not receive adequate pain management (Acute Pain Management Guideline Panel, 1992). In fact, Paiement, and colleagues (1979) found that 42% of a sample of 100 cardiac surgery patients reported pain from chest tubes and surgical incisions as the worst memory of their ICU stay. In addition, Puntillo (1990) reported more than 70% of the ICU patients (N=24) within her sample recalled having pain, and two thirds of the sample reported pain of moderate to severe intensity.

Pain in Cardiovascular Surgery Patients

Valdix and Puntillo (1995) compared the pain experiences of 39 cardiac surgery patients while in ICU to their recall of pain following transfer from the ICU. While in the

ICU (average of 34 hours after surgery), patients reported experiencing moderate to severe levels of pain, and rated pain relief from analgesics to be about 65%, using a 0-100% pain relief scale. Later recollections of pain and pain relief differed with patients reporting lower pain intensity levels and a higher percentage of relief when asked after ICU discharge, an average of 5.8 days after surgery.

In another study by Puntillo and Weiss (1994) the majority of cardiovascular surgery patients (N=74) complained of moderate levels of pain that did not decrease in intensity over the first three postoperative days. However, the total dose of analgesics administered to these patients did decrease over time. In this study, no relationship was found between the patient's age and the amount of pain reported by the patients, but these investigators did not report the relationship of age to analgesic administration.

Analgesic Use in ICU Patients

A substantial amount of the pain experienced by postoperative patients results from the inadequate prescription and administration of opioid analgesics (Kreitzer, Reuben, & Reed, 1991). Sun and Weissman (1994) investigated the use of analgesics and sedatives with critically ill postoperative patients and found that, on average, only 22-52% of the ordered analgesic dose was administered. The difference between the dose ordered and the dose administered increased over the days following surgery. In addition, the time interval between doses administered increased over the first three postoperative days.

Maxam-Moore, Wilkie, and Woods (1994) investigated the analgesic prescription and administration patterns of cardiac surgery patients (N=66) at two separate sites. They found long time intervals between the administration of drug doses. That is, the amount of time between morphine doses ranged from 5 minutes to 7.5 hours on the day of surgery (M=2 hours), 5 minutes to 15.7 hours on postoperative day one (M=3 hours), and 1.5 hours to 12 hours on postoperative day two (M=6 hours). In addition, the dose of morphine administered was found to be extremely small compared to the pro re nata (PRN) dose ordered. The average prescribed opioid dose was a minimum of 1.9 mg (SD=0.56 mg, range 0 to 5 mg) and a maximum of 6.6 mg (SD=2.7 mg, range 0 to 15 mg). The mean total amount of morphine administered during the study period of three days was 13.9 mg (Maxam-Moore, Wilkie, & Woods, 1994). No significant correlations were found between patient age and analgesia prescriptions and administration, except in cases where Acetaminophen with Oxycodone was ordered. In this case, a significant negative correlation was found between the patient's age and the amount of drug administered. Furthermore, elderly individuals, (i.e., average age of 64), were less likely to receive this medication when it was prescribed.

Faherty and Grier (1984) investigated analgesic postsurgical prescription and administration patterns and stratified their sample of 142 adult abdominal surgery patients into 10 year age groupings. The purpose of the study was to determine if elderly patients receive less analgesic medication compared with younger patients, and if so, how physicians' orders and the nurses' administration patterns contributed to the discrepancy. A Scheffe post hoc test showed that less analgesics were prescribed and administered as the age of the patient increased. There was a significant decrease in the mean amount of analgesics prescribed to those age 55 and greater (N= 83), and a significant decrease in the amounts administered to those aged 45 and greater (N=102) ($p<.001$). This was tested through comparisons made between the mean amount of analgesic medication prescribed versus the mean amount administered, using an independent Student's t-test. Of the total subjects (N=142), 52.1% received less than 50% of the dose prescribed. Of those subjects aged 25-54 (N=59), 40.7% received less than 50% of the prescribed dose. With advancing age, the amount administered versus the amount prescribed rose even higher. Of the subjects aged 55 and older (N=83), 60.2% received less than 50% of the dose prescribed.

Sun and colleagues (1992) investigated age related differences in the dosing of analgesics and sedatives in postoperative ICU patients, and they found an age-related difference in fentanyl dosing. Those patients who were 60 years of age or greater received significantly lower doses of epidurally administered fentanyl after thoracic surgery (N=13; dose 2.9 $\pm$ 1.7 mg/pt; $p<.02$) than those younger than 60 (N=19; dose 4.1 $\pm$ 1.4 mg/pt). The administration time period was not reported. Patients over 60 years of age received epidural fentanyl intermittently, while those less than 60 received epidural fentanyl via continuous infusion. This difference in administration pattern may help explain why those over 60 received less epidurally administered fentanyl than those less than 60 years of age since intermittent doses tended to be lower than continuous (0.64 $\pm$ 0.44 mg/day vs 1.37 $\pm$ 0.98 mg/day). The significant difference found in fentanyl dosing in those over 60 years of age suggests an age related bias in opioid prescription and administration may exist. This may be partially due to the concern of health care providers about potential adverse effects from use of continuous infusions in the elderly.

Sedation of ICU Patients

The primary goal of administering sedatives to critically ill patients is to decrease anxiety (Burns, Shelley, & Park, 1992). Cardiovascular surgery patients encounter a multitude of situational stressors which can lead to both emotional and somatic manifestations of anxiety (Rothenberg, 1993). Once the balance of coping behaviors are offset by such stressors, anxiety may ensue. Anxiety is one of the most commonly reported unpleasant phenomena experienced by patients in ICU, and it is estimated to occur in 70-87% of critical care patients (Bion, 1988). Although not classified as a sedative, opioids are the most common agents used for sedation in ICUs (Aitkenhead, 1989). In fact, in one study 37% of the ICU patients received opioid analgesics for routine sedation (Bion & Ledingham, 1987).

Recent work by Sun, Quinn, and Weissman (1992) suggests a shift towards using benzodiazepines, specifically midazolam, instead of opioids to produce sedation in ICU patients. Chi-square analysis revealed a significant increase in use of benzodiazepines and a decrease in use of narcotics over time. They concluded that use of benzodiazepines in combination with narcotics not only improves the quality of sedation, but it can reduce analgesic requirements. However, unlike the previously discussed age related differences found by these investigators in fentanyl dosing and administration, there were no differences in the doses of midazolam administered between those less than and greater than 65 years of age.

Like opioids, the differences in amount of benzodiazepines prescribed and administered is high. Dasta, Fuhrman, and McCandles (1994) found that while benzodiazepines were prescribed for 43% of 221 surgical ICU patients, only 27% of the maximally allowed dose was administered to these patients.

Thus, research to date suggests ICU postoperative patients are subjected to the inconsistent and limited administration of both opioids and benzodiazepines, and that age might be an influencing factor (Faherty, & Grier, 1984; Sun, Quinn, & Weissman, 1992). Studies are scarce that investigate the relationship between age and prescription and administration patterns of both opioids and benzodiazepines in a single patient population.

Non-ICU patients (Faherty & Grier, 1984) or ICU patients in multiple sites (Maxam-Moore, Wilkie, & Woods, 1994) and with multiple diagnoses (Sun, Quinn, & Weissman, 1992) have been used in previous studies. Data for this study was collected at a single site, thus controlling for some of those variables that could influence study results. Unlike previous investigations, this study will focus upon patterns of opioid and benzodiazepine prescription and administration within an ICU setting and will include a homogenous sample of cardiac surgery patients. While Sun, Quinn, and Wiessman primarily investigated dosing patterns, this study will expand its focus to include the prescribing patterns of physicians for both opioids and benzodiazepines. Finally, this study will eliminate those patients who received epidural analgesia. This is done in an attempt to control for intermittent epidural analgesia dosing by health care professionals other than nursing personnel, thus providing an accurate reflection of drug administration practices of nurses. In sum, this study investigated the differences according to age categories in opioid and benzodiazepine prescribing and administering patterns in one sample of cardiac surgery patients.

Method

Sample

Medical records were reviewed of 80 adult cardiac surgery patients undergoing valve replacements and coronary artery bypass surgery within a single metropolitan teaching hospital. Patients had been cared for in one of two ICUs between January 1994 and January 1995. Patients were excluded if they were under the age of 18 or if they had a noted history of opioid or benzodiazepine use for greater than one month prior to admission. Patients were included if they had intermittent (PRN) analgesic prescriptions. Those patients who received epidurally administered analgesics, patient controlled intravenous (IV) infusions or continuous IV infusions of opioids were not considered for inclusion within this study. Patients who received Vicodin during their ICU stay were excluded because equivalency dosage data are not available. In addition, any patient who returned to the operating room more than once during the first 72 hours following surgery was excluded from this study. After approval was obtained from the Committee on Human Research, 80 patients were selected from the computer generated list for analysis through a retrospective medical record review.

Instruments

A data collection form was developed by the investigator and reviewed by two pain researchers, one with expertise in critical care. All data were collected by a single investigator. Detailed information was obtained regarding the types, amounts, frequency, and routes for prescribing and administering opioids and benzodiazepines.

Procedure

Three consecutive days of chart data were collected. The days consisted of a 24 hour time frame, beginning and ending at the 2400 hour mark. The days were identified as (a) day of surgery (DOS), (b) postoperative day one (POD1), and (c) postoperative day two (POD2). Data were collected for up to three days or until the patient was discharged from ICU. Fifty-four of the 80 subjects remained in the ICU for three consecutive days, while the remainder were in ICU for two consecutive days. The average length of time spent in ICU on the DOS was M=7.8 hours. The average length of time spent in ICU on POD1 was a M=21.1 hours and on POD2 it was a M=14.5 hours. For each of the study days, the specific types of opioids and benzodiazepines prescribed and administered were recorded. For each 24 hour day, the following calculations were performed: (a) maximum amount of opioid prescribed, in morphine equivalency for a 24 hour period (b) total amount of opioid administered (c) maximum amount of benzodiazepine prescribed for a 24 hour period, in midazolam equivalency (d) total amount of benzodiazepine administered. Opioid and benzodiazepine conversion tables were used to convert the drugs to morphine equivalents or midazalom equivalents (Critical Care Pain Task Force Committee, 1995).

Statistical Analyses

Descriptive statistics were generated on the sample's demographic characteristics and to describe the amount of drugs prescribed and administered. The relationship between age group and the types of opioids and benzodiazepines prescribed and administered were analyzed using chi-square analysis. Independent Student's t-test were used to analyze the differences in the amounts of opioids and benzodiazepines prescribed and administered between the two age groups, those <65 years versus those ≥65 years. A two way analysis of variance (ANOVA) with a 2 x 2 factorial design was used to detect differences in opioid and benzodiazepine dose prescribed versus dose administered to the two age groups. The between subjects factor was age group and consisted of two levels; those <65 years and those ≥65 years of age. The within subjects factor had two levels: amount of drug prescribed and amount of drug administered. The ANOVA analyzed differences between age groups; differences between amount of drugs prescribed versus administered for the total sample; and differences between amount of drugs prescribed vs administered according to age group. Statistical significance was set a priori at $p \leq .05$ for all analyses.

Results

The mean age of the study population was 64 years (range 28 to 88 years). Thirty-nine patients were less than 65 years of age (M=54.92, SD=8.08, Range=28.0 to 64.0), and 41 were greater than or equal to 65 years (M=73.15, SD=5.98, Range=65.0 to 88.0). Fifty patients were men, and 30 were women. Forty-one percent of the patients were Caucasian, 10% were African American, 10% were Hispanic, 12.5% were Asian, 4% were Russian, 2.5% were Persian or Indian, 16% did not have their nationality identified in the chart, and 4% fell within the category of "other". Seventy-six percent of the study population were English speaking, and 24% had their primary language identified as "other". All patients were mechanically ventilated on the DOS. On POD1, 40 patients remained intubated, and 17 remained intubated on POD2. Table 1 presents the distribution of surgical procedures.

Types and Amounts of Opioids Prescribed, According to Age

There was no statistically significant difference in the types of opioids prescribed for those <65 compared to patients ≥65 years of age for any of the investigational days. Morphine was the most frequently prescribed opioid for both age groups. Table 2 lists the types of opioids prescribed according to age.

There was no statistically significant difference in the amounts of opioids prescribed for those <65 compared to patients ≥65 years of age for any of the investigational days. On the DOS, the maximum amount of opioid prescribed for those <65 years was M=105.25 mg versus M=104.97 mg in those ≥65 years of age. On POD1, the maximum amount of opioid prescribed for those <65 years was M=112.73 mg versus M=108.00 mg in those ≥65 years of age. On POD2, the maximum amount of opioid prescribed for those <65 years was M=130.34 mg versus M=110.00 mg in those ≥65 years of age.

Types and Amounts of Benzodiazepines Prescribed, According to Age

There was no statistically significant difference in the types of benzodiazepines prescribed for those <65 compared to patients ≥65 years of age for any of the investigational days. Midazalom was the most frequently prescribed benzodiazepine for both age groups. Table 3 list the types of benzodiazepines prescribed according to age.

There was no statistically significant difference in the amounts of benzodiazepine prescribed for those <65 compared to patients ≥65 years of age for any of the investigational days. On the DOS, the maximum amount of benzodiazepine prescribed for those <65 was M=30.15 mg versus M=25.17 mg in those ≥65 years of age. On POD1, the maximum amount of benzodiazepine prescribed for those <65 years was M=30.30 mg versus M=26.97 mg in those ≥65 years of age. On POD2, the maximum amount of benzodiazepine prescribed for those <65 years was M=35.10 mg versus M=27.63 mg in those ≥65 years of age.

Types and Amounts of Opioids Administered, According to Age

There was no statistically significant difference in the type of opioids administered to those <65 years versus those ≥65 years of age. Morphine was the most prevalent form of opioid administered to both groups on all three days. In those <65 years, morphine was administered to 30 patients on the DOS, to 35 patients on POD1, and to 17 patients on POD2. In those patients ≥65 years of age, morphine was administered to 29 patients on the DOS, 35 patients on POD1, and 26 patients on POD2. On the DOS three patients from group one (<65) and four patients from group two (≥65) were administered demerol to control shivering. On the DOS five patients from the <65 years age group and eight from the ≥65 years age group received no form of opioid. On POD1, one patient from each age group received no form of opioid and on POD2, one patient from group one and three patients from group two received none. Table 4 lists the types of opioids administered, according to age.

On the DOS and POD1, no statistically significant difference was found in the amount of opioids administered to those <65 years compared to patients ≥65 years. On the DOS a total opioid amount of M=8.81 mg was administered to those patients <65, and

M=9.97 mg was administered to those ≥65 years of age. On POD1, a total opioid amount of M=15.32 mg was administered to those patients <65, and M=11.35 mg was administered to those ≥65 years of age.

However, a statistically significant difference was found in the total opioid dose administered to the two age groups on POD2. Patients <65 received significantly higher doses of opioids than those ≥65 (M=15.86 mg; SD=13.51, versus M=9.72; SD=9.06; $p<.05$).

Types and Amounts of Benzodiazepines Administered, According to Age

There was no statistically significant difference in the type of benzodiazepine administered to those <65 years versus those ≥65 years of age. Midazalom was the most prevalent form of benzodiazepine administered to both groups on all three days. In those <65 years, midazalom was administered to 20 patients on the DOS, to 18 patients on POD1, and to 8 patients on POD2. In those patients ≥65 years of age, midazalom was administered to 22 patients on the DOS, to 21 patients on POD1, and to 10 patients on POD2. On the DOS 17 patients from group one and 18 patients from group two received no form of benzodiazepine. On POD1, 19 patients from each age group received no form of benzodiazepine and on POD2, 12 patients from group one and 21 patients from group two received none. Table 5 lists the types of benzodiazepines administered, according to age.

No statistically significant difference was found in the amount of benzodiazepine administered to those <65 compared to patients ≥65 years of age. On the DOS, a total benzodiazepine amount of M=1.79 mg was administered to those patients <65 and

M=1.69 mg was administered to those ≥65 years of age. On POD1, a total benzodiazepine amount of M=1.74 mg was administered to those patients <65 and M=1.29 mg was administered to those ≥65 years of age. On POD2, a total benzodiazepine amount of M=1.60 mg was administered to those patients <65 and M=0.76 mg was administered to those ≥65 years of age.

Opioids Prescribed versus Administered, According to Age

The present study employed a 2 x 2 factorial design with age differential (<65 and ≥65) as one variable and opioid dose amount (prescribed vs administered) as the other. The results of the analysis of variance testing the main effect of patient age, disclosed that there was no significant difference between the two age groups for any of the three ICU days. Although there was a significantly greater amount of opioids prescribed versus the administered on all three study days (DOS, $F_{1,78}=376.510$, $p<.001$; POD1, $F_{1,78}=199.143$, $p<.001$; POD2, $F_{1,78}=116.556$, $p<.001$), the difference was not age-related. That is, there was no significant interaction between patient age group and opioid prescription-administration dose differences on any of the three study days. Figure1 displays opioid prescription and administration doses for the total patient population across the three days.

Benzodiazepines Prescribed versus Administered, According to Age

A 2 x 2 factorial design with age differential (<65 and ≥65) as one variable and benzodiazepine dose (prescribed vs administered) as the other. The results of the analysis of variance to test the main effect of patient age revealed no significant difference between the two age groups for any of the three ICU days.

Although there was a significantly greater amount of benzodiazepines prescribed versus administered for each of the three days (DOS, $F_{1,78}=147.015$, $p<.001$; POD1, $F_{1,78}=136.167$, $p<.001$; POD2, $F_{1,51}=62.916$, $p<.001$), the difference was not age-related. That is, there was no significant interaction between patient age group and benzodiazepine prescription-administration dose differences on any of the three study days. Figure 2 displays benzodiazepine prescription and administration doses for the total patient population across the three days.

Discussion

This study examined patterns of prescribing and administering analgesics and sedatives to cardiac surgery patients, and explored the relationship of age to these patterns. Comparisons were made between those younger than 65 years and those equal to or greater than 65 years of age.

No statistically significant differences were found between the two age groups in terms of the types and amounts of opioids and benzodiazepines prescribed. These results are consistent with earlier findings in a similar patient population (Maxam-Moore, Wilkie, & Woods, 1994), except that none of our patients received acetamenophen with oxycodone. Physicians at our study site used standardized cardiac post-surgical opioid and benzodiazepine prescription forms. Thus, choice of analgesia and sedatives may not truly reflect the types of opioid and benzodiazepine choices that would be made if physicans wrote individualized prescriptions. Less standardization could result in a smaller discrepancy between the types and dosage amounts of opioid and benzodiazepines prescribed.

While use of standardized forms limited the variability in prescriptions, nurses had significant leeway in making decisions in the amount of opioids administered. Age aside, on all three study days there was a significant difference between the opioids prescribed as compared to administered. One explanation for the differences between the large amounts prescribed versus the small amounts administered may be nurses' concerns about adequacy of their patient's ventilatory status, and the fear of inducing hemodynamic and respiratory instability. Although these fears are prevalent, they are not be well founded. Various experimental studies have shown that use of IV morphine in conventional doses, as high as 1 mg/kg body weight for cardiac patients, had minimal adverse hemodynamic effects (Alderman, Barry, Grahamn, & Harrison, 1972; Lee et al., 1976; Loweinstein, Hallowell, & Levine, 1969). Furthermore, Arunasalam and colleagues (1983) studied the ventilatory response of young (mean age=34.5) and old subjects (mean age=72.7) to morphine and concluded that IV morphine 10 mg/70 kg body weight did not produce greater ventilatory depression in the older subjects versus those younger.

The only difference noted in our study in administration practices occurred on POD2 when the older age group received significantly less opioids than the younger. Sun, Quinn and Weissman (1992) also found that significantly lower doses of opioids were administered to those greater than 60 years of age. An explanation for the decreased administration of opioid medications to those $\geq$65 may result from the misconception that there is a decreased sensitivity to painful stimuli, an increase in the pain threshold (Harkins & Chapman, 1977), and decrease in thermal pain perception (Harkins, Price, & Martelli, 1986; Evans et al., 1992) that accompanies aging.

Another possible explanation for the decreased analgesic administration is the belief that elderly patients require less medication due to prolonged drug absorption, distribution, metabolism, and excretion resulting from the normal physiological alterations associated with aging (Greenlee, 1991). These physiological alterations include changes in body composition, decrease in circulating serum proteins, and decrease in renal mass, renal blood flow, glomerular filtration rate and tubular secretion (Kaiko, Wallenstein, Rogers, Grabinski, & Houde, 1982; Lamy, 1983; Lamy, 1984; Lonergan, 1988; Ouslander, 1981). However, investigational research has shown that, when used judiciously, opioids can be safely administered to the elderly (Bellville, Forrest, Miller, & Brown, 1971). These investigators reported no differences in the frequency and type of side effects reported by patients ≥58 years of age versus those <58 when either 10 mg of morphine, 20 mg of pentazocine, or both were administered for postoperative pain.

Although statistical significance was not established, interesting trends were noted in the present study. The mean difference in the maximum amount of opioid prescribed to those patients <65 versus those patients ≥65 progressively increased across the three study days (DOS; M=0.275 mg, POD1, M=4.73 mg, POD2; M=20.34). That is, older patients were prescribed progressively less analgesics over time.

The above findings reflect that, despite use of standardized order sheets, there are obvious discrepancies between the amounts of sedatives and analgesics prescribed to patients <65 versus patients ≥65 years of age. There was a tendency for physicians to prescribe a lower opioid dose for elderly post surgical patients. In addition, the above trends indicate patients ≥65 years are more likely to be administered substantially lower doses of opioids versus patients <65 years of age. This may be attributed to the misconceptions surrounding the effects of physiological aging upon pain sensation and opioid pharmokinetics.

The overall large discrepancies between the amounts of opioids and benzodiazepines prescribed versus administered raise questions about nurses' treatment decisions. Cohen (1980) found that nurses tended to select the lowest possible dose within the range of choices available to them. In our study, patients received average mean opioid doses of only 9 to 13 mg. Further study is warranted of decision making processes of ICU nurses who are providing pain management.

The primary type of benzodiazepine prescribed in both age groups within this cardiac surgery population was midazolam, a finding consistent Sun and Weissman (1994). Like Sun, Quinn, and Weissman (1992) we found no significant difference in the relationship between age and amount of benzodiazepines administered, although a significant difference did occur between that which was prescribed versus that administered, unrelated to age. The fact that benzodiazepines were scarcely being administered makes one question the possibility of undersedation. Benzodiazepines may promote relaxation and eliminate situations in which the patient may inflict self harm, as well as assisting in the promotion of sleep. Undersedation could have detrimental effects upon the recovery process. Further research is warranted on the relationship between assessing level of sedation (through use of validated sedation scales) and administration of sedatives to ICU patients.

Conclusion

The purpose of this study was to determine the relationship between age and prescription and administration of opioids and benzodiazepines in postoperative ICU cardiac patients. Older patients received less opioids during at least one phase of their ICU recovery period. The reason for this difference is unknown and warrants further study.

The overall small administration doses for both the opioids and benzodiazepines may have influenced our ability to detect statistically significant differences in prescription and administration patterns according to age. Therefore, further replication of this study with larger sample sizes is warranted. Also needed is further investigation of relationships between pain and sedation levels and amounts of medications received. Investigating the rationale behind medication choices could assist in changing future patient care practice. Improvement in analgesia and sedation practices may allow us to better serve patient needs and assist in promoting recovery.

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Table 1

Distribution of Surgical Procedures

Surgical Procedure	*N*=
Coronary Artery Bypass Graft (CABG)	10
CABG + Single Internal Mammary Artery Pedicle Graft (IMAPG)	34
CABG + Bilat IMAPG	8
Valve Replacement	8
Aortic Repair	4
CABG + Single IMAPG + Valve Replacement	5
DBL Valve Replacement	1
DBL Valve Replacement + Percutaneous Lines Placed	1
Thoracic Aortic Aneurysm Repair	1
CABG + Single IMAPG + Valve Repair + Atrial Thrombectomy	1
CABG + Valve Replacement + IABP placement	2
Valve Replacement + Aortic Aneurysm Repair	1
CABG + Bilat IMAPGs + Bilat Lobectomy	1
CABG + Bilat IMAPGs + Gastropyloric Artery Pedicle Graft	2
CABG + Bilat IMAPGs + Right Coronary Artery Thrombendarectomy + Intra-Aortic Balloon Pump	1

TABLE 2

TYPES OF OPIOIDS PRESCRIBED BY AGE

	NONE		MORPHINE		FENTANYL		MORPHINE + FENTANYL		MORPHINE + DEMEROL		FENTANYL + DEMEROL	
	<65	≥65	<65	≥65	<65	≥65	<65	≥65	<65	≥65	<65	≥65
DOS	1	0	34	37	0	0	3	1	1	3	0	0
POD1	1	0	34	33	0	2	2	4	2	1	0	1
POD2	0	0	13	28	2	0	3	4	2	1	0	0

TABLE 3

TYPES OF BENZODIAZEPINES PRESCRIBED BY AGE

	NONE		MIDAZOLAM		DIAZEPAM		DIAZEPAM + MIDAZOLAM		MIDAZOLAM + LORAZEPAM	
	<65	≥65	<65	≥65	<65	<65	≥65	<65	≥65	<65
DOS	1	1	36	39	0	0	0	0	2	1
POD1	1	1	35	37	1	0	0	2	2	1
POD2	0	1	20	29	0	0	0	2	0	1

TABLE 4

TYPES OF OPIOIDS ADMINISTERED BY AGE

	NONE		MORPHINE		FENTANYL		MORPHINE + FENTANYL		MORPHINE + DEMEROL		FENTANYL + DEMEROL		DEMEROL	
	<65	≥65	<65	≥65	<65	≥65	<65	≥65	≥65	<65	≥65	<65	<65	≥65
DOS	5	8	30	29	1	0	0	0	2	4	0	0	1	0
POD1	1	1	35	35	2	0	0	2	1	1	0	2	0	0
POD2	1	3	17	26	1	2	2	2	0	0	0	0	0	0

TABLE 5

<u>TYPES OF BENZODIAZEPINES ADMINISTERED BY AGE</u>

	NONE		MIDAZOLAM		DIAZEPAM		DIAZEPAM + MIDAZOLAM		MIDAZOLAM + LORAZEPAM		LORAZEPAM	
	<65	≥65	<65	≥65	<65	≥65	<65	≥65	<65	≥65	<65	≥ 65
DOS	17	18	20	22	1	1	0	0	1	0	0	0
POD1	19	19	18	21	0	0	0	1	1	0	1	0
POD2	12	21	8	10	0	0	0	0	0	0	1	0

Figure 1

Amounts of Opioids Prescribed versus Administered for the Total Patient Population.

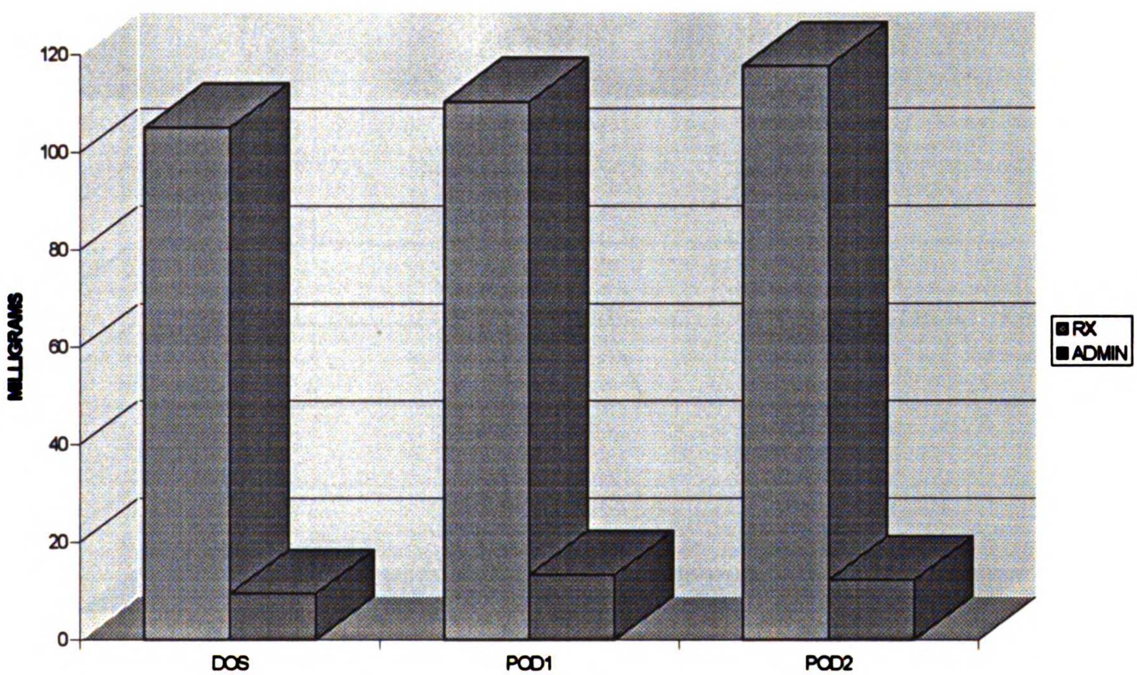

Figure 2

Amounts of Benzodiazepines Prescribed versus Administered for the Total Patient Population.