

# Morphine Based Anesthetic Allows Early Discharge from the Intensive Care Unit in Children Undergoing Cardiac Surgery

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## ABSTRACT

**Introduction:** At our institution morphine was not being used as a part of balanced anesthetic technique because of fear of delayed extubation and prolonged mechanical ventilation. Nalbuphine is the most commonly used opioid at our institution and has been the sole opioid used in pediatric cardiac surgery procedures up until recently. We retrospectively compared the ICU stay of children who underwent cardiac surgery with either morphine as their sole opioid or nalbuphine.

**Materials and methods:** A retrospective review of all patients undergoing corrective or palliative cardiac surgery for a congenital cardiac anomaly from December 1, 2010 through May 2011 was done. Patients were categorized into two groups, Group A received morphine and Group B received nalbuphine.

**Results:** A total of 144 patients qualified for the study. Group A, the morphine group, had 23 patients, while Group B had 121 patients. For Group A the overall mean ICU stay was 2.56 days (1-10 days) for the whole group, for closed heart procedures the mean ICU stay was 2.42 days (1-10 days) and for open heart procedures mean ICU stay was 2.6 days (1-5 days range). For Group B patients the mean ICU stay for the whole group was 3.14 days (0-39 days range). The mean ICU stay for closed heart procedures was 2.6 days (0-39 days) and 3.66 days (1-25 days) for open heart procedures. Statistical analyses were performed on a personal computer with the statistical package SPSS for Windows (Version 13.0, SPSS, Chicago). Statistical analysis revealed that the mean duration of stay in the ICU was shorter in Group A and this did approach statistical significance ( $p=0.075$ , 95% CI: 1.6-7.89). The ICU stay for open heart procedures was shorter in Group A and also approached statistical significance.

**Conclusions:** In children undergoing open and closed heart surgeries, morphine based anesthetic does not delay ICU stay when compared to nalbuphine and data analysis suggests that morphine based anesthesia may shorten ICU stay in selected patients undergoing cardiac surgery.

**Keywords:** Morphine, Anesthesia, ICU.

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## INTRODUCTION

Nalbuphine is the most commonly used opioid at our institution and has been the sole opioid used in pediatric cardiac surgery procedures up until recently. Morphine was not being used as a part of balanced anesthetic technique because of fear of delayed extubation and prolonged mechanical ventilation. We retrospectively compared the ICU stay of children who underwent cardiac surgery with either morphine as their sole opioid or nalbuphine. There was no increase in ICU stay in our patients who had received morphine. Morphine use in hospitals is under strict government control in Pakistan due to concerns of abuse and misuse. Anesthesiologists in Pakistan have limited exposure to morphine and very few use morphine for postoperative pain management.

Nalbuphine, a mixed agonist-antagonist opioid with ceiling effect on respiratory depression<sup>1</sup>, is widely and easily available and is the most commonly used opioid for pain management at our institution, including cardiac surgery.

Nalbuphine has been the sole opioid used in pediatric cardiac surgery procedures up until recently. Morphine was not being used as a part of balanced anesthetic technique because of fear of delayed extubation and prolonged mechanical ventilation. We undertook to use morphine as a part of balanced anesthesia for children undergoing closed and open heart surgeries and found that it did not lead to increased ICU stay in our patients.

## MATERIALS AND METHODS

A retrospective review of all patients undergoing corrective or palliative cardiac surgery for a congenital cardiac anomaly from December 1, 2010 through May 2011 was done. Patient demographics, data regarding anesthetic regimens, stay in the ICU

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and other variables were evaluated. This information had been collected from chart reviews, operative, anesthetic records and personal physician records. The departmental cardiac surgery database was also used to collect data. The gathered data was then entered into a structured database in Microsoft Office Excel 2007. All patients undergoing thoracic, vascular and other non- cardiac procedures as well as mortalities were excluded from the study.

Group A patients, in the morphine group, undergoing open heart procedures received 0.1-0.2mg/kg of morphine in the pre-bypass period, another 0.1- 0.3mg/kg during bypass and a morphine infusion was started prior to coming off bypass. This was continued in the postoperative period and discontinued 2-4 hours prior to extubation. Patients undergoing closed heart surgeries received morphine 0.1-0.2mg/kg during the surgery without any morphine infusion.

Group B patients, in the nalbuphine group, undergoing open heart surgeries received 0.1-0.3mg/kg of nalbuphine in the prebypass period, 0.1-0.3mg/kg during bypass and 0.1-0.3mg/kg in the post bypass period. Patients undergoing closed heart procedures in nalbuphine group received 0.1-0.2mg/kg of nalbuphine during the surgery.

## RESULTS

A total of 204 patients underwent surgeries in the Department of Cardiothoracic and Vascular Surgery at our institution. Of these a total of 144 patients qualified for the study. Patients were divided into two groups. Group A included those who received morphine while those who received Nalbuphine were included in Group B.

A total of 144 patients qualified for the study. There were 63 females and 81 males. The overall mean age was 35.02 months (0.5-168 mo). The mean weight was 10.05 kg (2.5-38 kg). 65 patients underwent closed heart procedures and 80 underwent open heart procedures. The average ICU stay was 3.17 days (0-39 days).

Group A. the morphine group, had 23 patients and was smaller than Group B as only a single anesthesiologist among the care providers used morphine. The average age in Group A was 36.44 months (2.5-156 mos). The mean weight was 11.45 kg (3.3-35 kg). Seven underwent closed heart procedures and 17 under went open heart procedures. The overall mean ICU stay was 2.56 days (1-10 days) for the whole group. For closed heart procedures the mean ICU stay was 2.42 days (1-10 days) and for open heart procedures mean ICU stay was 2.6 days (1-5 days range).

There were 121 patients in Group B, the nalbuphine group. The mean age was 34.5 months (0.5-168 mo.) and the mean weight was 9.70 kg (2.5-38 kg). 58 patients under went closed heart procedures and 63 underwent open heart procedures. The mean ICU stay for the whole group was 3.14 days (0-39 days range). The mean ICU stay for closed heart procedures was 2.6 days (0-39 days) and 3.66 days (1-25 days) for open heart procedures. **Statistical analysis:** Statistical analyses were performed on a personal computer with the statistical package SPSS for Windows (Version 13.0, SPSS, Chicago). Differences between group means were tested by the Student's t-test and checked by the Mann-Whitney U test. P values less than 0.05 were considered statistically significant and all tests were two-tailed

Statistical analysis revealed that the mean duration of stay in the ICU was shorter in Group A and this did approach statistical significance ( $p=0.075$ , 95% C: I 1.6-7.89), but did not achieve it. Similarly subset analysis showed that in Group A the ICU stay for open heart procedures also approached statistical significance ( $p=0.068$ , 95% CI: 1.4-5.9). There was no statistically significant difference in the ICU stay in closed heart patients in either group ( $p=1.22$ , 95% CI: 0.15-17.89).

## DISCUSSION

Nalbuphine allows very early extubation but is unreliable in supplementing surgical anesthesia in cardiac patients. It lacks the property to attenuate cardiovascular and hormonal responses to surgical procedures and is not recommended in patients undergoing cardiac surgery procedures<sup>2</sup>.

The initiation of cardiopulmonary bypass induces complement activation, endotoxin release, leukocyte activation, the expression of adhesion molecules, and the release of many inflammatory mediators. This systemic inflammatory response (SIRS) that has been associated with postoperative organ dysfunction<sup>3,4,5</sup>. Experimental data suggests that morphine suppresses complement and neutrophil function by morphine-stimulated No release mediated by the  $\mu^3$  opiate receptor subtype found on immunocytes<sup>6</sup>. Fentanyl has no immunosuppressive effects.

Murphy et al looked at 30 patients undergoing elective coronary artery bypass graft in a double-blind study, receiving either morphine (40mg) or fentanyl (1000 mcg) as part of a standardized opioid-isoflurane anesthetic. Several components of inflammatory response (IL-6, CD 11b, CD 18, postoperative hyperthermia) were suppressed in the morphine group as compared to the fentanyl group<sup>7</sup>.

Morphine, but not fentanyl, is also associated with improvement in global ventricular function in patients undergoing CPB<sup>8</sup>. Compared with fentanyl, morphine enhanced early recovery in patients after cardiac surgery. It decreased pain scores on postoperative days 1 and 2 and decreased analgesic requirements in the early recovery period and the frequency of febrile reactions postoperatively<sup>9</sup>.

The disadvantages of a morphine-based anesthetic that have been noted included, slow onset of action, histamine release with hypotension and unclear optimal dose for cardiac patients<sup>10</sup>.

In our study, ICU stay in both the morphine group and nalbuphine group was very comparable. Morphine displayed some advantages in selected subgroups. There are some limitations in our study. The number of patients in the two groups was disproportionate and other variables that effect ICU stay could not be excluded.

In conclusion, in children undergoing open and closed heart surgeries, morphine based anesthetic does not delay ICU stay when compared to nalbuphine and has the advantage of suppressing systemic inflammatory response and decreases analgesic requirements.

## CONCLUSION

In children undergoing open and closed heart surgeries, morphine based anesthetic does not delay ICU stay when compared to nalbuphine and has the advantage of suppressing systemic inflammatory response and decreases analgesic requirements. Data analysis suggests that morphine based anesthesia may shorten ICU stay in selected patients undergoing cardiac surgery.

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