Multimodal Analgesia following Multilevel Thoracolumbar Spine Surgery is Associated with Improved Postoperative Function and Discharge Disposition

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INTRODUCTION:

Pain during the postoperative period has been a significant challenge for both patients and health care providers alike. Major spine surgery is associated with an increased level of pain traditionally requiring opioid medications, which have been associated with adverse consequences. As a result, there has been an increased effort to reduce postoperative opioid usage through various methods, including multimodal analgesia (MMA), which has shown success following spine surgery in reducing opioid usage postoperatively. However, to the best of our knowledge, there have not been any investigations specifically looking at the effectiveness of MMA in regard to objective postoperative functional measurements and patient disposition following their hospitalization.

The purpose of this study was to investigate whether patients receiving multimodal analgesia demonstrated improved post-operative function and disposition following major spinal reconstructive surgery, which for this study was defined as open lumbar fusions +/- decompression between 2 - 5 levels.

We investigated the impact of MMA versus single agent, patient controlled analgesia (PCA), for each of the following patient outcomes: (1) daily patient-reported pain scores, (2) daily patient function as quantified by ambulation distance and need for assistance with physical therapy, (3) hospital length of stay, and (4) patient disposition to home versus inpatient rehabilitation. We hypothesized that MMA would result in increased ambulation distance with physical therapy, decreased need for assistance with ambulation, shorter hospitalizations, and a greater percentage of discharges to home.

METHODS:

The study design is a preintervention and postintervention retrospective cohort study. MMA was first instituted at our medical center in 2022. Following approval by our institutional review board, we collected data on a consecutive series of patients for a one-year period prior to MMA implementation (PCA group) and another consecutive series of patients for one year following implementation. All patients who underwent 2 – 5 level open, posterior lumbar fusion surgery were included. Minimally-invasive, anterior and lateral procedures were excluded from the study. Furthermore, patients who could not participate in physical therapy postoperatively were excluded.

Data collected included daily numeric pain scores (0-10), ambulation distance, need for physical therapy (PT) manual assistance when transitioning or ambulating, length of stay, and disposition from the hospital (home versus inpatient rehab). Chi-squared analysis was used to calculate p-values which were considered significant if $p < 0.05$. Logistic regression was also utilized to model patient disposition, specifically discharge to home versus inpatient rehab.

RESULTS:

Patient characteristics

There were 192 patients in the MMA group and 235 in the PCA group (overall n=427). Patient demographics were similarly matched between the two groups. There were no significant differences between the MMA and PCA groups when comparing age (MMA=64.9 years, PCA=65.3 years; p= 0.67), sex (MMA: n=113 female and 122 male. PCA: n=101 female and 91 male; p=0.353), ASA score (ASA I: MMA n=2, PCA n=1; ASA II: MMA n=121, PCA n=81; ASA III: MMA n=112, PCA n=108; ASA IV: MMA n=0, PCA n=2; p=0.109), methadone use (MMA n=2, PCA n=2; p=0.839), numbers of levels fused (2-3 levels fused: MMA n=185, PCA n=159; 4-5 levels fused MMA n=50, PCA n=33; p=0.288), patients who underwent revision surgery (MMA n=172, PCA n=131; p=0.261) and those who required TLIF (MMA n=136, PCA n=97; p=0.129). Patients in the PCA group had a higher BMI (MMA=29.6, PCA=30.9; p=0.019). All patients were discharged either to home or inpatient rehab by POD #5.

Post-operative pain scores

The MMA group reported lower numeric pain scores on postoperative days 1 through 4 (POD#1: MMA 4.7 and PCA 5.8; POD#2: MMA 4.2 and PCA 5.3; POD#3: MMA 4.0 and PCA 5.1; POD#4: MMA 4.0 and PCA 5.4; p<0.001). There was no statistical difference with pain scores at POD#5 (MMA: 4.4, PCA 5.3; p=0.56).

Post-operative function

The MMA group demonstrated significantly longer walking distance (feet) at all stages of the postoperative period (POD#1: MMA 38.2' and PCA 19.2'; POD#2: MMA 106.1' and PCA 60.2'; POD#3: MMA 131.3' and PCA 85.2'; POD#4: MMA 127.5' and PCA 73.3'; POD#5 MMA 151.3' and PA 64'; $p<0.001$).
The MMA group demonstrated lower rates of requiring manual assistance with physical therapy at POD#2-5 (POD#1: MMA 70.80% vs. PCA 76.70% $p = 0.176$; POD#2: MMA 29.00% vs PCA 55.50%; POD#3: MMA 16.40% vs PCA 40.80% $p < 0.001$; POD#4: MMA 20.30% vs PCA 40.60% $p < 0.001$; POD#5: MMA 8.80% vs. PCA 52.90% $p < 0.001$).

Post-operative disposition

The MMA group demonstrated shorter length of stay (MMA 3.2 days, PCA 3.5 days; $p<0.003$) and increased likelihood of being discharged home vs inpatient rehab (MMA 217 of 235 patients discharged home vs PCA 150 of 192 patients; $p<0.001$). Logistic regression analysis demonstrated that patients in the MMA group had 2.96 times increased odds of getting discharged home (95% CI 1.61-5.44, $p<0.05$).

DISCUSSION AND CONCLUSION:

MMA was superior to PCA in patients undergoing multi-level spinal fusion with regard to post-operative pain, function and hospital disposition. Lower pain scores reported in this study are consistent with previously reported findings. Unique to this investigation, however, we found that MMA was associated with improved ambulation distances, reduced need for PT manual assistance, shorter length of stay, and higher likelihood of discharge home rather than to an inpatient rehab facility.

Our study also suggests that MMA may contribute to health care expenditure savings. With rising healthcare costs and increasing emphasis on value-based care, MMA may play an important role by reducing hospital length of stay, PT resource utilization and need for transfer to skilled nursing facilities following multilevel spinal fusion procedures.