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Scientific Abstracts > Regional Anesthesia

# Retrospective study comparing outcomes of multimodal epidural and erector spinae catheter pain protocols after pectus surgery

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## Introduction

There is no consensus on optimal pain management for the Nuss procedure which is one of the most painful procedures adolescents undergo. Due to difficult pain control with epidural discontinuation, we switched to a multimodal erector spinae (ESP) catheter protocol which allows ambulatory analgesia1,2 The goal of this study was to compare epidural and ESP catheter cohorts for length of stay (primary outcome) and use of oral opioids beyond POD7.

## Materials and Methods

After IRB approval, data was collected retrospectively for patients who underwent pectus surgery with multimodal thoracic epidural protocol (January-December 2019; N=114) and multimodal ESP protocols (March 2020 - May 2021; N=97). Data collected included demographics, comorbidities, analgesic adjuncts, pain scores and opioids administered, Haller index, length of stay, time to perform regional procedure, surgical duration and chest tube placement. Outpatient data collected included pain assessments, POD last dose of medication use, side effects noted in pain clinic/follow up calls and ED visits. Outcomes were compared with adjustment for propensity scores using inverse probability of treatment weighing (IPTW) to balance the two groups for all covariates.

## Results/Case Report

Patient and surgical characteristics were similar between the groups except for higher block time (median (IQR): 21 minutes (19, 29) vs. 12 minutes (10, 18), $p<0.001$) and lower preoperative pain scores (median NRS (IQR) 0 (0,0) vs. 0 (0,0), $p=0.015$) in ESP group. Ketamine and dexmedetomidine boluses were used more in ESP group (12% vs. 1.8%, $p = 0.002$; 27.8% v 3.5% $p<0.001$ respectively). After adjusting for significant covariates, in-hospital opioid use (POD0-2 morphine equivalents: oral + intravenous opioids) between the groups was not significantly different ($p=0.449$). After IPTW adjusted for preoperative pain, LOS ($p < 0.001$) and odds for opioid use beyond POD7 ($p < 0.001$) were significantly lower in the ESP group.

## Discussion

Our study findings show that use of multimodal erector spinae catheter protocols for Nuss procedures is effective in decreasing LOS (by a day) and need for oral opioids beyond POD7, with pain/side effect/readmission profiles comparable to thoracic epidural protocols. Randomized controlled trials are needed to further compare safety/efficacy of ESP protocols to cryoanalgesia being adopted by several centers for Nuss procedures.

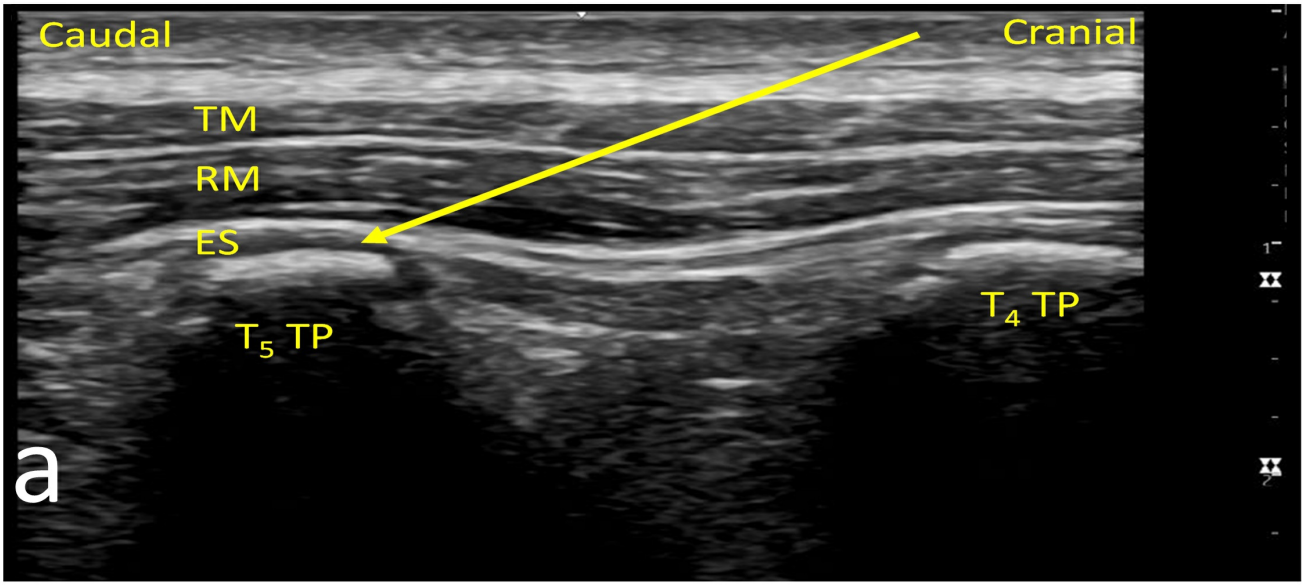
## References

1. Tsui BCH et al. J Clin Anesth. 2019;53:29-34.
2. Gurria JP et al. J Pediatr Surg. 2020;55(12):2690-2698.

## Disclosures

No

## Tables / Images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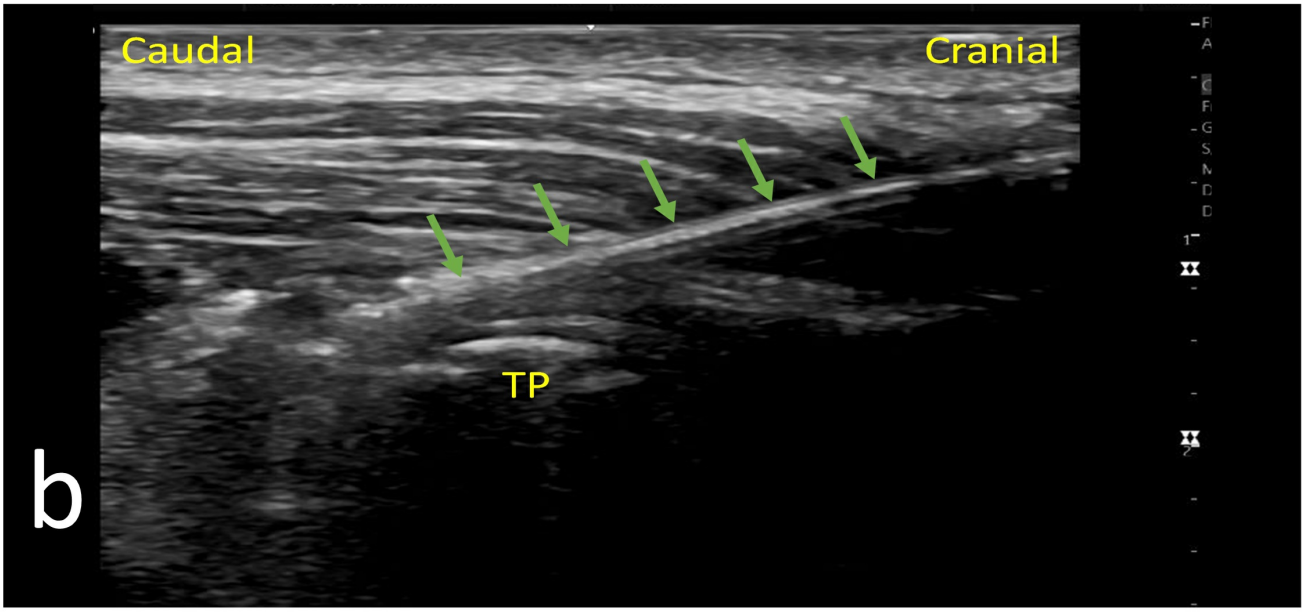
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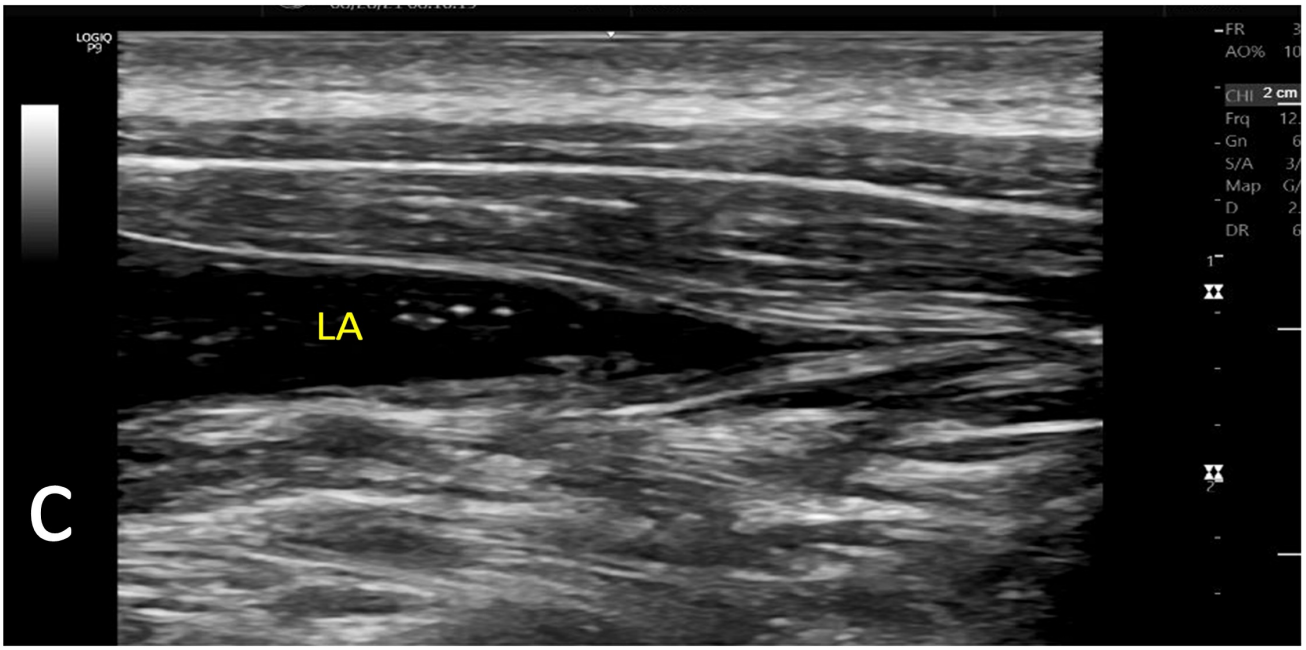
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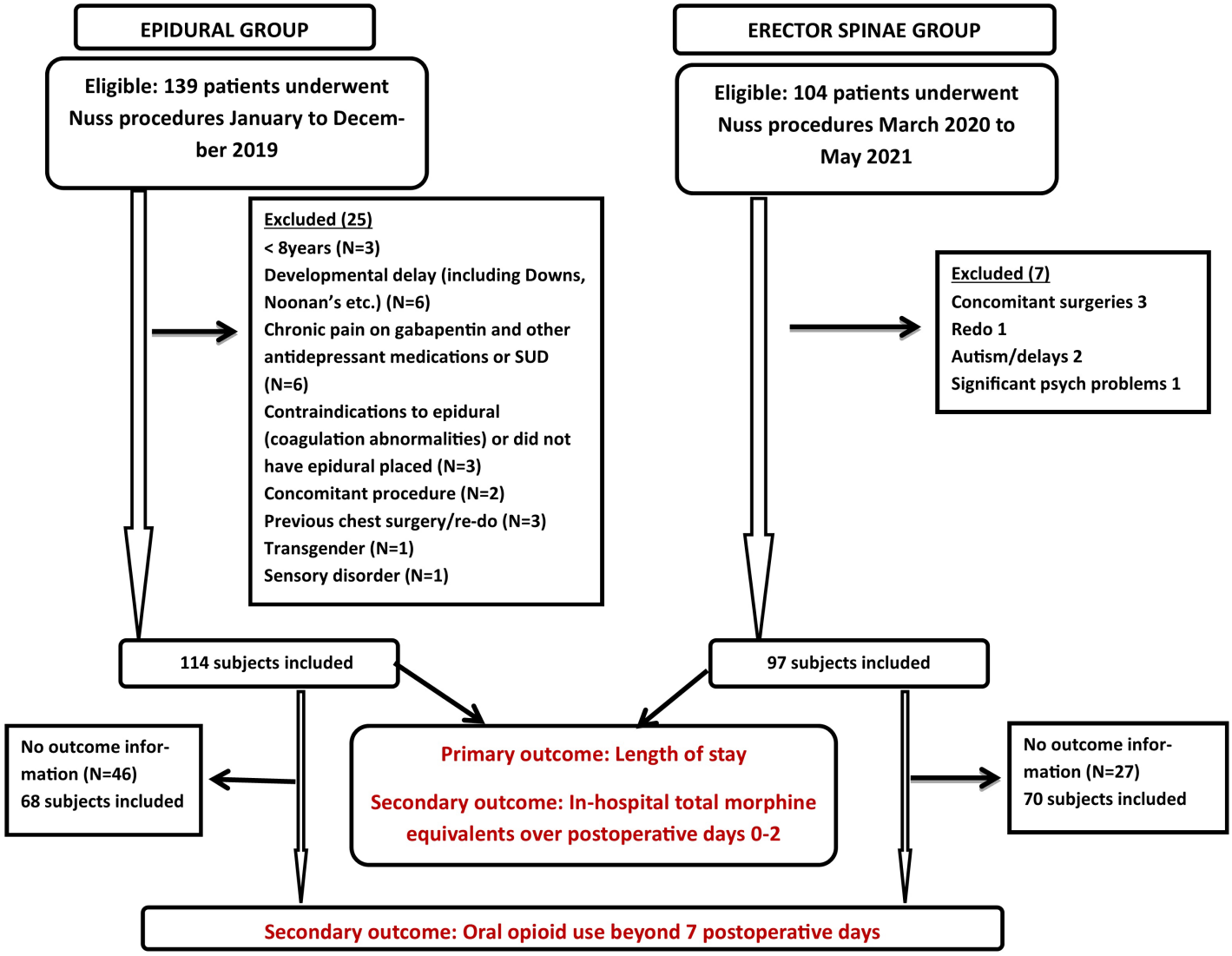
EPIDURAL GROUP
Eligible: 139 patients underwent Nuss procedures January to December 2019
Excluded (25)
< 8years (N=3)
Developmental delay (including Downs, Noonan's etc.) (N=6)
Chronic pain on gabapentin and other antidepressant medications or SUD (N=6)
Contraindications to epidural (coagulation abnormalities) or did not have epidural placed (N=3)
Concomitant procedure (N=2)
Previous chest surgery/re-do (N=3)
Transgender (N=1)
Sensory disorder (N=1)
114 subjects included
No outcome information (N=46)
68 subjects included
ERECTOR SPINAE GROUP
Eligible: 104 patients underwent Nuss procedures March 2020 to May 2021
Excluded (7)
Concomitant surgeries 3
Redo 1
Autism/delays 2
Significant psych problems 1
97 subjects included
No outcome information (N=27)
70 subjects included
Primary outcome: Length of stay
Secondary outcome: In-hospital total morphine equivalents over postoperative days 0-2
Secondary outcome: Oral opioid use beyond 7 postoperative days

Table 1: Detailed description of perioperative pain protocols for Nuss procedure: Multimodal ambulatory erector spinae plane catheter protocol (ESP) and multimodal thoracic epidural (EPI) pain protocol

| | Erector spinae (ESP) | Epidural (EPI) |
|---|---|---|
| | **Preoperative** | |
| **Preparation** | ▪ Education and teaching about post-operative pain management done in pectus class and in the preoperative assessment | |
| **Premedication** | ▪ Scopolamine patch 1.5 mg<br>▪ Pregabalin 25 mg PO (if < 50 kg) or 50-75 mg PO (if > 50 kg) | |
| | **Intraoperative** | |
| **Anesthesia** | ▪ General endotracheal anesthesia: Intravenous induction with fentanyl, lidocaine, propofol and muscle relaxant per discretion of anesthesia team<br>▪ Maintenance with inhalational anesthesia. muscle relaxants, and opioids as needed<br>▪ Methadone 0.1 mg/kg IV (max 5 mg)<br>▪ Diazepam 0.05 mg/kg IV (max 5 mg) after tracheal extubation<br>▪ Acetaminophen 15 mg/kg IV (max 1000 mg)<br>▪ Ketorolac 0.5 mg/kg IV (max 15 mg)<br>▪ Ketamine IV bolus per anesthesia discretion | |
| **Regional analgesia** | ▪ Bilateral ultrasound guided erector spinae catheters placed with an initial bolus of 0.5 ml/kg with max dose of 20 ml of 0.2% ropivacaine with dexmedetomidine 0.25 mcg/kg, per side | ▪ Thoracic (T5-T6) epidural placed with initial bolus of 8-10 ml 0.2% ropivacaine |
| | **PACU/POD 0** | |
| **Regional Anesthesia** | ▪ Ropivacaine infusion were initiated at 0.2 mg/kg/hr to each catheter on CADD Solis pump with clonidine max 0.1 mcg/kg/h each side.<br>▪ For typical patient >50 kg body weight: 0.15% ropivacaine + clonidine 0.5 mcg/ml 6ml/h or PIB 6ml q60 min + demand doses 4 ml q4-6h prn, as allowed by weight | ▪ Ropivacaine infusion initiated at 0.2 mg/kg/hr (+/- clonidine 0.5 mcg/ml) via epidural pump.<br>▪ For typical patient > 50 kg body weight: 0.2% ropivacaine + clonidine 0.5 mcg/mL infusing 8 ml/hr with 4 ml q4h PRN breakthrough pain |
| **Other** | ▪ Dexmedetomidine 0.1-0.2 mcg/kg per anesthesiologist (maximum 8 mcg) in PACU | ▪ Methadone 0.1 mg/kg (max 5 mg) after 12 hours of intraoperative dose |
| **Analgesic medication** | ▪ Acetaminophen 15 mg/kg IV (max 1000 mg) every 6 hours<br>▪ Methocarbamol 15 mg/kg IV (max 1000 mg) every 8 hours<br>▪ Diazepam 0.05 mg/kg IV (max 5 mg) every 4 hours as needed for chest tightness and muscle spasm<br>▪ Hydromorphone 0.1 mg/kg IV (max 0.5 mg) as needed for severe sharp pain<br>▪ Ketorolac 0.5 mg/kg IV (max 15 mg) every 6 hours | |

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| | | |
|---|---|---|
| | ▪ Lorazepam 0.5 mg every 6 hours as needed for anxiety (per pain team discretion) | |
| **Opioid side effect management** | ▪ Ondansetron 0.1 mg/kg IV (max 8 mg) every 8 hours | |
| | **POD 1** | |
| **Regional Anesthesia** | Continue ESP/epidural infusions | |
| **Analgesic medication** | ▪ PO opioid (oxycodone 0.1 mg/kg or hydromorphone 0.04 mg/kg) offered every 4 hours starting at 7 am (typically 5 mg oxycodone or 2 mg hydromorphone doses)<br>▪ Diazepam 0.05 mg/kg PO (max 5 mg) every 4 hours<br>▪ Continue IV acetaminophen, IV ketorolac, IV methocarbamol in the morning and switch all to enteral formulations by the end of the day<br>▪ Ice packs to incisions as needed for incisional soreness | |
| **Opioid side effect management** | ▪ Continue ondansetron<br>▪ For patients >12 years old, naloxegol 12.5 mg PO for patients < 50 kg and 25 mg for patients > 50 kg once daily for 2 days | |
| **Non-Pharmacological measures** | ▪ Integrative care/holistic health, physical and occupational therapy consults<br>▪ Ice pack to incisions/hot packs for muscle tightness as needed | |
| | **POD 2** | |
| **Regional Anesthesia** | ▪ Exchange to home CADD®-Solis pumps with typical dosing for patients > 50 kg: 0.15% ropivacaine 6 ml q 60 min (PIB) or 6 ml/hr with a patient demand dose 4 ml q6hr as needed<br>▪ Provide education about home care of ES catheters including signs of infection, signs of local anesthetic toxicity, how to remove catheters, how to care for catheters and catheter dressings and provide contact information for acute pain service | ▪ Ropivacaine infusion stopped 6am<br>▪ Epidural catheter removed by pain team on morning rounds |
| **Analgesic medication** | ▪ Transition to oral medications completed<br>▪ Continue oral acetaminophen, oral ibuprofen, oral oxycodone/hydromorphone, oral methocarbamol, oral diazepam | |

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| | | |
|---|---|---|
| **Opioid side effect medication** | ▪ Complete naloxegol course<br>▪ Oral ondansetron as needed | |
| **Discharge** | ▪ Discharge home when goals met | |
| | **POD 3-5** | |
| **Regional Anesthesia** | ▪ Continue ropivacaine infusion through ES catheters using home CADD®-Solis infusion pump<br>▪ Patient/family remove ES catheters at home on POD 1 when infusion is complete | |
| **Analgesic Medication** | ▪ Continue scheduled oral acetaminophen, ibuprofen, methocarbamol<br>▪ Oral oxycodone/hydromorphone every 4-6 hours as needed for pain<br>▪ Oral diazepam every 4 hours as needed for chest tightness/muscle spasm | |
| **Opioid side effect management** | ▪ Continue scopolamine patch for 7 days in all<br>▪ Oral Ondansetron as needed<br>▪ Bowel regimen per surgery team (senna and polyethylene glycol) | |
| | **POD 10-14** | |
| **Follow-up** | ▪ Pain Clinic and surgery postoperative clinic follow up within 2 weeks after surgery | |

Table 1: Univariate analysis in ESP protocol and epidural protocol groups, and weighting by the inverse probability of treatment

| **Variables** | ESP (n=97) | Epidural (n=114) | SMD | p-value | p-value/SMD after IPTW* |
|---|---|---|---|---|---|
| Age (yrs, mean ± SD) | 16.19 ± 3.62 | 15.73 ± 4.41 | 11.3 | 0.067 | |
| Weight (kg, mean ± SD) | 59.7 ± 10.56 | 56.69 ± 4.41 | 25.5 | 0.165 | p = 0.66 |
| Haller Index (mean ± SD) | 5.54 ± 2.53 | 6.07 ± 4.98 | 13.4 | 0.863 | |
| Preop pain (NRS, mean ± SD) | 0 ± 0 | 0.16 ± 0.88 | 25.6 | 0.015 | p = 0.08 |
| Anxiety (moderate/severe) | 64.17% | 65.3% | 48.4 | 0.061 | |
| Block time (min, median (IQR)) | 21 (19, 28) | 12 (10, 18) | | <0.001 | |
| Chest tube | 1.03% | 0.88 | 1.58 | 0.91 | |
| Long Distance | 24.74% | 36.84% | 26.4 | 0.059 | SMD: 14.75 |
| Surgical Duration (hrs, mean ± SD) | 3.37 ± 0.61 | 3.31 ± 0.77 | 9.33 | 0.323 | |
| Dexmedetomidine^ | 27.8% | 3.5% | 71.01 | <0.001 | SMD: 27.11 |
| Lorazepam^ | 18.6% | 28.1% | 22.64 | 0.105 | SMD: 21.00 |
| Ketamine^ | 12.4% | 1.8% | 42.36 | 0.002 | SMD: 2.12 |
| **Comorbidities** | | | | | |
| Behavioral | 23.71% | 31.58% | 17.65 | 0.204 | |
| Cardiovascular | 11.34% | 5.26% | 22.2 | 0.106 | SMD: 1.84 |
| Muscular Skeletal | 9.28% | 4.39% | 19.5 | 0.155 | |
| Neurologic | 5.15% | 3.51% | 8.1 | 0.735 | |
| Respiratory | 28.87% | 29.82% | 2.1 | 0.879 | |
| Syndromes | 6.19% | 6.14% | 0.2 | 0.989 | |
| **Outcomes** | | | | | |
| LOS (days) | 2.21 ± 0.5 | 3.31 ± 0.69 | | | |
| Oral opioid use>7 days | 33.8% | 71.6% | | | |
| Average pain (NRS, mean ± SD) | 4.48 ± 1.36 | 3.83 ± 1.59 | 44.07 | 0.002 | p = 0.69 |
| Overall MEQ (mean ± SD) | 0.19 ± 0.14 | 0.24 ± 0.1 | 45.80 | <0.001 | SMD: 2.18 |
| **Side effects** | | | | | |
| Emesis (yes) | 4.12% | 28.95% | 70.9 | <0.001 | p = 0.91 |
| Numbness | 16.5% | 12.3% | | 0.382 | |
| ED visits | 7.2% | 4.4% | | 0.376 | |
| Re-admissions | 3.1% | 0.9% | | 0.336 | |
| **Multivariable regression results (after IPTW)** | | | | | |
| LOS # | 2.17 (95% CI: 2.06-2.29) | | 3.35 (95% CI: 3.33 -3.47) | | <0.001 |
| Oral opioid need>7 POD | OR (95% CI) ESP vs Epidural: 0.122 (0.054 - 0.274) | | | | <0.001 |

*NRS – Numerical rating scale for pain (0-10); POD0-2; SMD:44.1 ; IPTW:0.7;*

**Reported only if corrected using propensity scores (SMD>0.2 or p-value<0.05)*

^ Adjusted for in hospital MEQ (including also age, sex, weight, Haller's index, preoperative pain, anxiety intensity , presence of chest tube, comorbidities, surgical duration)

LOS (dependent) - age, sex, weight, Haller's index, preoperative pain, anxiety intensity, presence of chest tube, comorbidities, long distance or not, surgical duration, emesis, average pain over POD0-2 and overall opioid MEQ/kg (including both oral and IV opioid use) over POD0-2

Oxycodone/hydromorphone >7 PODs (dependent) - age, sex, weight, Haller's index, preoperative pain, anxiety intensity, presence of chest tube, comorbidities, surgical duration, average pain over POD0-2 and overall opioid MEQ/kg (including both oral and IV opioid use) over POD0-2