Cardiac surgery is associated with significant acute pain and a proportion of these patients will develop chronic post sternotomy pain (Ref 1, 2)

Opioids are the main stay of analgesia in cardiac surgery because of the safer hemodynamic profile and sedation (3). However high dose narcotic use is associated with a variety of unwanted side effects prolonging postoperative recovery. There is growing evidence for the effectiveness of multimodal approach utilizing opiate sparing techniques for enhancing patient recovery following surgery (4, 5, 6, 7). Early extubation has been associated with improved patient outcome and cost effectiveness in cardiac surgery (8, 9, 10).

Our objective is to assess the effectiveness of an opioid sparing multimodal approach for enhancing the recovery in Cardiac Surgical patients. This model would use a combination of intravenous (Dexmedetomidine, Ketamine, Lidocaine) and Intrathecal (Morphine) drugs.

All of the above anesthetic drugs have opioid sparing effect in surgical patients (11, 12,13).
Dexmedetomidine use has been associated with decreased atrial arrhythmias and improved neurological outcome in cardiac surgical patients (14, 15).
Ketamine has been linked with attenuation of postoperative cognitive dysfunction after cardiac surgery (16,17).
Both intravenous lidocaine and intrathecal morphine has been shown to reduce narcotic consumption in the perioperative period (18, 19, 20)

Hypotheses
Primary hypothesis– multimodal analgesia would improve pain scores at 24hr post extubation

Secondary hypothesis – multimodal approach would decrease opioid requirement in the first 24 hrs and enhance organ function recovery in the postoperative period

Methods:
Assuming mean pain score = 5 in control (21); test =3 (2 point difference); stdev=2.5; n = 26/group (56 total subjects assuming a 8% drop out rate).

Prospective randomized trial with blinding at the stage of data analysis.

Study group: will receive pre-operative intrathecal duramorph (4mcg/kg up to max dose of 300mcg), intra-operative infusion of Ketamine (0.4 mg/kg/hr), Lidocaine (20 mcg/kg/min) and Dexmedetomidine (0.25 mcg/kg/hr) started after induction and maintained through the CPB towards the end of surgery. At this point all infusions will be turned off except Dexmedetomidine (0.25 mcg/kg/hr) which will be continued until the patient is extubated. The total intraoperative fentanyl dose will be limited to <250mcg (or 3mcg/kg).
Control group: will receive unrestricted amount of intraoperative opioids at the discretion of the Anesthesiologist

Both groups will receive volatile agents and single dose of iv Tylenol intraoperatively and total midazolam to <2mg.
Postoperatively both groups will receive PRN iv Tylenol and PRN iv Opioids.

Inclusion criteria: Elective CABGs and/or Valve replacements

Exclusion criteria: Re-do cardiac surgery, Acute endocarditis, Circulatory arrest, Emergent cases, Shock, LVADs, Transplantation, TAVR, contraindications for neuraxial including coagulopathy and Clopidogrel <7days, psychosis, known allergy to any of the study drugs, Preoperative liver dysfunction (AST/ALT > 2 times normal) and Renal dysfunction (Cr > 2 mg/dL)

Drop outs: If a patient in the study group appears to require more narcotics than 250mcg of Fentanyl or midazolam >2mg, the patient will receive so and be dropped from the trial. Circumstances where the study protocol is not followed will lead to dropping out of those patients from the trial.

Outcome Measures

Primary outcomes - Pain score at 24hr after extubation
Secondary outcomes - Postoperative opioid consumption (in first 24 hrs), Extubation time, ICU Length of stay, Delirium scores, Inotropic requirement, patient satisfaction scores (in first 24 hrs)

Data collection

(Post op - Pain scores, sedation, nausea, vomiting, itching, hemodynamics, and respiratory parameters will be measured at 2, 4, 8, 12, 24, 48 & 72 hrs post extubation)

Pain scores – starting from 2hr post extubation, 11 point verbal rating scale, timing as above

Opioid consumption – first 12 hrs, thereafter daily and total (iv and PO)

Time of Extubation

Lengths of stay: ICU LOS, In-hospital LOS, 30 day readmission rate

Delirium: CAM-ICU measured at 24, 48 and 72 hrs

Inotrope requirement – Intraop, postoperative, total

Patient satisfaction with pain management score: in the first 24 hrs measured at above intervals

Complications:

Cardiac complications: Atrial fibrillation on EKG, Arrhythmias requiring treatment, CHF (requiring 2 or more inotropes or use of IABP >24 hrs), MI (new Q waves in EKG or elevation of Troponins)

Respiratory complications – Mechanical ventilation >24hrs, desaturations, reintubations

Neurological complications – CVA, TIA, Post-operative delirium (measured by Delirium scores: CAM-ICU)

Renal complications: acute increase in Creatinine >50% of baseline or the need for dialysis

Gastrointestinal complications: Ileus (Measured as time of return of bowel function - POD to first oral liquid/flatus/stool)

Infectious complications: Surgical site infections, other organ infection, sepsis

Opioid related Side effects: Nausea, vomiting, pruritus, sedation (RASS score), urinary retention – measured as above

Other Perioperative and postoperative data collected: Anesthesia time, CPB time, Cross clamp time, Fluids, PRBC, FFP, Platelets, Cryoppt, Urine output, Electrical defibrillation, No of defibrillations, Pacing, Time of ventilation weaning

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