

## EFFICACY OF LIGNOCAINE AND MULTIMODAL ANALGESIA IN REDUCING PAIN POST-CORONARY ARTERY BYPASS GRAFTING PATIENTS

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### Abstract

**Background:** Pain after coronary artery bypass grafting (CABG) affects recovery, breathing, and risk of cardiac complications. Opioids are commonly used but carry risks such as respiratory depression and sedation, making non-opioid adjuncts worth studying. Lignocaine and paracetamol are two such options with established safety profiles.

**Objective:** To compare intravenous lignocaine infusion with scheduled intravenous paracetamol and tramadol for postoperative pain control in the first 24 hours after elective on-pump CABG. **Methods:** Fifty-two patients undergoing elective on-pump CABG were randomized into two equal groups. Group A received intravenous lignocaine infusion (1.5 mg/kg/hr for 12 hours postoperatively), and Group B received scheduled intravenous paracetamol and tramadol. All patients received standard general anesthesia and postoperative care. Pain was measured at rest and during coughing using the Numerical Rating Scale (NRS) at 0, 3, 6, 9, 12, and 24 hours after extubation.

**Results:** The two groups were not fully matched at baseline: the multimodal group was older ( $61.69 \pm 10.06$  vs.  $54.62 \pm 9.80$  years,  $p=0.013$ ), had more males (73.1% vs. 42.3%,  $p=0.025$ ), and more kidney disease (38.5% vs. 7.7%,  $p=0.008$ ). Hypertension and diabetes were similar between groups. Pain scores at rest and during coughing were comparable between groups at most time points (0, 3, 6, 9, and 24 hours). At 12 hours, the lignocaine group had significantly lower pain scores both at rest [2 (IQR 2) vs. 3 (IQR 2),  $p=0.044$ ] and during coughing [2 (IQR 1.50) vs. 4 (IQR 2.25),  $p=0.013$ ]. Within both groups, pain scores changed significantly over the 24-hour period ( $p<0.001$  for all comparisons).

**INTRODUCTION**

Coronary Artery Bypass Grafting is a major heart surgery performed to improve blood flow to the heart. When coronary arteries become narrowed or blocked by plaque, the heart muscle can't get enough oxygen. During CABG, a surgeon takes a healthy blood vessel from another part of the patient's body—like the chest, leg, or arm—and creates a new route, or "bypass," around the blocked artery. This allows blood to flow freely again, which can relieve chest pain (angina), reduce the risk of a heart attack, and improve heart function and quality of life. It is often referred to as open-heart surgery or simply "bypass surgery." Coronary artery disease is a prevalent heart disease that forms plaque inside the vessels, narrowing the vessels and compromising blood circulation, which leads to hypoperfusion of cardiac tissues. The primary issue is a high level of cholesterol and fats within the tissue.<sup>1</sup> The mortality rate of coronary artery disease in 2019 worldwide one-third of deaths, in Asia the ratio varies on the base of area while in Pakistan, the mortality rate is 918.18 per 100000 patients. If we compare gender wise the ratio in male is high.<sup>1</sup>

When discussing the signs and symptoms of coronary artery disease, a key presentation is chest pain radiating to the left side of the shoulder as well as the left side of the face, accompanied by nausea and vomiting. The main pathophysiology involves decreased blood flow to cardiac tissue, which can further lead to a myocardial infarction.<sup>2</sup>

While infusion Paracetamol is an anti-inflammatory class of drug used for mild to moderate pain, lignocaine is a local anesthetic agent that blocks sodium ion channels to relieve pain. According to my study, we will compare both drugs for postoperative pain management to determine which one provides better pain relief. The problem is that in all patients, we can't use opioids, which cause respiratory depression, nausea, and vomiting; on the other hand, only anti-inflammatories are not sufficient for better relief of pain. We aim to reduce drug doses and improve pain management for postoperative coronary bypass grafting surgery.<sup>1</sup>

Lignocaine blocks sodium channels, relieves

pain without urinary retention. Opioids induce respiratory depression, but nausea and vomiting is not produced. The problem is that to provide better postoperative pain relief. The current problem is that opioids are potent but have some adverse effects.<sup>1,2</sup>

There is a wide range of analgesic techniques used for postoperative pain control in coronary artery bypass surgeries, like multimodal analgesia and paracetamol with fentanyl. Postoperative pain management aims to eliminate and reduce pain with minimal adverse effects, and also causes delayed recovery and increases post-hospital stay.<sup>3</sup>

The most serious complication in Early postoperative pain produces fear, anxiety, nausea & vomiting, which can lead to different complications like wound side bleeding and increased hospital stay.<sup>4</sup>

Paracetamol is a non-steroidal anti-inflammatory class of drug that blocks the synthesis of prostaglandin in the central nervous system. It acts on the peripheral nervous system to modulate the system and reduce pain.<sup>5</sup>

**Rationale Of the Study**

CABG (Coronary Artery Bypass Grafting) is a major heart surgery performed to improve blood flow to the heart. When coronary arteries become narrowed or blocked by plaque, the heart muscle can't get enough oxygen. During CABG, a surgeon takes a healthy blood vessel from another part of the patient's body—like the chest, leg, or arm—and creates a new route, or "bypass," around the blocked artery. This allows blood to flow freely again, which can relieve chest pain (angina), reduce the risk of a heart attack, and improve heart function and quality of life. It is often referred to as open-heart surgery or simply "bypass surgery." Paracetamol is a common, over-the-counter pain reliever and fever reducer. It works mainly in the brain and spinal cord to ease mild to moderate pain and reduce high temperature. It's gentle on the stomach and widely used for headaches, muscle aches, and after surgery. In hospitals, it is often given through a vein (IV) for fast and reliable pain relief after operations.

Lidocaine is a local anesthetic and anti-arrhythmic medicine. When used locally, it numbs a specific area to block sodium ion channels the cell become resting pain signals—like at the dentist. When given slowly through a vein (IV infusion) after major surgery, it can help reduce overall pain and the need for strong opioid painkillers. It works by temporarily blocking pain signals along nerves, helping patients recover more comfortably.

Pain is a subjective experience and part of surgery due to injury, but it also has psychological and socioeconomic consequences. Poorly controlled or uncontrolled pain can cause a cascade of complications and it is not just an undesirable side effect of surgery. The potential postoperative complications of uncontrolled surgical pain can include myocardial ischemia, impaired pulmonary function, ileus, thromboembolism, impaired immune function, prolonged duration of opioid use, and anxiety. 7

Postoperative pain remains a significant clinical challenge after major surgeries such as coronary artery bypass grafting (CABG). Inadequate pain control after CABG can lead to increased physiological stress responses, delayed recovery, impaired respiratory function, prolonged hospital stay, and increased opioid requirements. Although opioids are commonly used for postoperative analgesia, their use is associated with adverse effects including nausea, vomiting, sedation, respiratory depression, and delayed recovery. Therefore, there is a need to explore effective multimodal analgesic strategies that can reduce postoperative pain while minimizing opioid-related complications.8

Postoperative pain management remains a major challenge after major surgical procedures, including coronary artery bypass grafting (CABG). Although opioids are commonly used for postoperative pain relief, concerns regarding opioid-related adverse effects have increased interest in non-opioid analgesic approaches. Poorly controlled postoperative pain may result in increased physiological stress responses, impaired respiratory function, delayed mobilization,

prolonged hospitalization, and reduced patient recovery.9

As part of the Roma Pain Days session on Multimodal Analgesia for the Effective Treatment of Acute Pain, a presentation was given on acute postoperative pain; and how prompt, effective treatment may reduce the risk that persistent post-surgical pain will develop.10

Intravenous lignocaine has gained attention as a component of multimodal analgesia due to its analgesic, anti-inflammatory, and opioid-sparing properties. Previous studies have demonstrated that IV lignocaine can reduce postoperative pain intensity and opioid consumption in various surgical procedures. However, evidence regarding its effectiveness specifically in patients undergoing CABG remains limited. Furthermore, while paracetamol combined with tramadol is widely used for postoperative analgesia, the comparative efficacy of lignocaine versus paracetamol–tramadol combination therapy after cardiac surgery requires further evaluation..9

Previous studies have mainly focused on opioid-based analgesia and invasive techniques, with limited evidence on effective non-opioid alternatives. Few studies have directly compared intravenous lignocaine with paracetamol–tramadol combination therapy, especially after CABG surgery.10

Postoperative pain following laparoscopic cholecystectomy remains a major concern because inadequate pain control can delay recovery, prolong hospital stay, and reduce patient satisfaction. Identifying effective non-opioid analgesic strategies is essential to minimize opioid-related adverse effects and improve postoperative outcomes.11

This study is significant because it evaluates the analgesic efficacy and safety of intravenous lidocaine and dexmedetomidine as alternatives to opioid-based analgesia. Comparing these agents may help identify the most effective strategy for reducing postoperative pain, analgesic requirements, and hemodynamic instability. The findings of this study may contribute to the development of improved multimodal analgesic protocols, resulting in better postoperative recovery, fewer

complications, shorter hospitalization, and enhanced quality of patient care.<sup>12</sup>

Lignocaine reduces pain primarily by blocking voltage-gated sodium channels, thereby preventing the transmission of pain signals through nerve fibers. It also has anti-inflammatory and antihyperalgesic effects by reducing inflammatory mediators and central sensitization. In addition, intravenous lignocaine decreases postoperative opioid requirements and improves pain control.<sup>13</sup>

Tramadol relieves pain through both central and peripheral mechanisms. It acts as a weak  $\mu$ -opioid receptor agonist and inhibits the reuptake of serotonin and norepinephrine, thereby reducing pain transmission in the central nervous system. In addition, tramadol has local anesthetic properties that suppress peripheral nerve conduction and decrease peripheral and central sensitization.<sup>14</sup>

Paracetamol exerts its analgesic effect primarily through inhibition of prostaglandin synthesis in the central nervous system, thereby reducing pain perception. It also acts on central serotonergic pathways, contributing to its analgesic properties. As part of multimodal analgesia, paracetamol reduces postoperative pain and decreases opioid requirements and opioid-related adverse effects.<sup>14</sup>

The aim of this study is to evaluate the efficacy of lignocaine and paracetamol-tramadol analgesia in reducing postoperative pain and improving rehabilitation outcomes in patients undergoing coronary artery bypass grafting (CABG).<sup>15</sup>

inadequately managed pain may result in increased postoperative pulmonary complications, cardiac complications (e.g. infarction, arrhythmias) and long-term complications such as poststernotomy pain syndrome.<sup>16</sup>

Multimodal analgesia combines different analgesics and techniques that block or modulate pain stimulus in every point of its pathway from periphery to cerebral cortex relying on the "aggregation of marginal gains" theory, in what small gains in each stage can result in a greater improvement.<sup>17</sup>

Use of more than one analgesic modality has become the necessity in order to achieve effective PP control [11,30]. Systemic

administration of two or more drugs that are strategically combined to block pain perception at various locations in the peripheral and central nervous systems.<sup>18</sup>

It has been suggested that intravenous (IV) lidocaine prevents the depolarization of neurons of damaged or dysfunctional nerves and reduces or prevents neo-proliferation of active sodium channels in these nerves.<sup>19</sup>

#### **Aims And Objectives**

➤ To evaluate the efficacy of lidocaine and paracetamol Tramadol in reducing pain following post-operative coronary artery bypass grafting patients.

➤ To compare post-operative outcomes in patients who were given paracetamol Tramadol and lidocaine infusion

#### **LITERATURE REVIEW**

Postoperative pain management is a challenging task for post-operative coronary artery bypass grafting patients. After studying many relevant studies, it is concluded that coronary artery bypass grafting pain management is very crucial there are many modalities for post-operative pain management like continuous infusion of paracetamol and opioids and multimodal analgesia. Some patients are having renal problem and respiratory problems. we can't give opioids and NSAID because of their comorbidities the alternate is lignocaine.

Gill et al. (2025) study was conducted in Pakistan, it is a randomized clinical trial of 76 patients having 2 groups. In the first group inject local anesthetic lidocaine 2% and in group 2 inject local anesthetic artician 4% for anesthesia and analgesia. The numerical rating scale was applied, then the study concluded that artician is more potent than lignocaine 2%.<sup>6</sup>

**J Qiu • 2019.** A study was conducted in china; it is a triple blinded randomized clinical trial of 100 patients having two groups. In the first group inject local anesthetic lidocaine 2% and in group 1<sup>st</sup> inject local anesthetic lignocaine with combination of adrenaline for pain. The 3<sup>rd</sup> group was control group injected normal saline. The pain assessment tool was applied (NRS), then the study concluded that

lignocaine with adrenaline is more potent than lignocaine.<sup>7</sup>

Khan TH, et al. Professional Med J. 2019 A study was conducted in Pakistan karachi, it is a randomized clinical trial of 120 sample size having three groups. In the first group injection toradol swab the group 2<sup>nd</sup> received lidocaine 2% and 3<sup>rd</sup> group received normal saline for post-operative tonsillectomy pain management after 30 minutes assessed the pain through pain scale (NRS) there is no significant difference in L group and T group the pain was seen in S group but the difference is seen in duration of analgesia the L group as compare to S group the analgesic consumption non significance.<sup>9</sup>

Arora P, et al. Anesth Essays Res. 2018. A study was conducted in india, it is a double blinded randomized clinical trial of 120 sample size having two groups. In the first group injection dexamethasone 0.1mg/kg diluted in 10ml normal saline while the group 2<sup>nd</sup> received lidocaine 2% 2mg/kg diluted in 10 ml normal saline for post-operative laparoscopic cholecystectomy the pain was assessed through pain scale (NRS) there is no significant difference in L group and D group on the base of post-operative recovery.<sup>10</sup>

Mishra PK, et al. Anesth Essays Res. 2020. A study was conducted in India, it is a prospective randomized double blinded study 60 full time pregnant sample size having two groups. In the first group injection nalbupine 0.2mg/kg while the group 2<sup>nd</sup> received injection paracetamol 15mg/kg for post-operative c-section the pain was assessed through pain scale (NRS) there was a significant difference in N group and P group the pain high in paracetamol compared to nalbupine.<sup>11</sup>

Qin J, et al. Indian J Anaesth. 2025. A study was conducted in china, it is a systematic review and meta analysis 1056 review were included from different libraries like Cochrane, pubmid, google scholar, NCBI to check the efficacy of lignocaine on hemodynamic stability during intubation compared with non-lignocaine group after that they were assessed iv lignocaine suppress the response against the intubation (MAP) [MD: -3.85; 95% confidence interval (CI): -6.61, -1.09; P = 0.006; I2 = 84%] and heart rate (HR) (MD: -4.72; 95% CI: -7.55, -1.90; P =

0.001; I2 = 86%) conclusion that iv lignocaine suppress the response of intubation.<sup>12</sup>

Jose A, et al. Indian J Anaesth. 2023. A study was conducted in india, it is a randomized control trial of 120 sample size to compare the efficacy of lignocaine dexmedetomidine 1microgram/kg loading dose over 10 minute followed by infusion 0.5microgram/kg/h for maintenance along with injection lignocaine 1.5mg/kg followed by 1.5mg/kg/h the 2<sup>nd</sup> group received morphine 0.15mg/kg after that observed the propofol requirement is higher in morphine group compared to DL group. The study conclude that combination of DL is better than single morphine.<sup>13</sup>

Shekhar S, et al. Saudi J Anaesth. 2024. A study was conducted in Saudi Arabia , it is a randomized control exploratory study of 105 sample size to compare the efficacy of lignocaine and dexmedetomidine 1microgram/kg loading dose over 15 minute followed by infusion 0.5microgram/kg/h for maintenance along with injection lignocaine 2mg/kg followed by 1.5mg/kg/h the last group received normal saline 4–8ml/h till suturing of skin after that observed the stress response is high in normal saline and lignocaine is compared to dexmedetomidine the study conclude that dexmedetomidine is better then lignocaine.<sup>14</sup>

Rajan S, et al. Ann Afr Med. 2025. A study was conducted in india , it is a retrospective observational study of 40 participant were participated to compare Analgesic Efficacy of Extended Opioid-free Anesthesia Regimen with Intravenous Lignocaine 0.5mg/kg/h versus Morphine 0.02mg/kg/h the study conclude that lignocaine is compared to morphine is less potent (20% vs 80%) .<sup>15</sup>

Masri et al., 2025 A study was conducted in Saudi Arabia , it is a prospective randomized control double blinded study. There are two group each group having 24 participant to compared the effect of intra-operative infusion lignocaine on desflurane. The first group was inject lignocaine infusion while the 2<sup>nd</sup> group only desflurane after that conclude that the lignocaine decrease the requirement of desflurane so that the desflurane was not effective is compared to lignocaine infusion 1microgram/kg loading dose over 15 minute

followed by infusion the dose 1.5mg/kg/ followed by 1mg/kg/h for maintenance heart rate ,mean arterial pressure and saturation of oxygen was maintained.<sup>16</sup>

**Masri et al., 2025.** A study was conducted in Pakistan Karachi , it is a prospective randomized control study. There are two group each group having 50 participant to compared the effect of infusion lignocaine and low dose ketamine post-operative laproscopic cholecystectomy the lignocaine bolus dose 1mg/kg followed by the same dose for maintainance while ketamine 0.2mg/kg followed by same dose for maintenance the pain was assessed through nomrical rating scale in 0,2,4,6,12,24hours, from the first zero the NRS was same no significant difference but 12 and 24 hrs the ketamine was good analgesic the result conclude that there is no significant difference in 2,4 hourse but after that ketamine was best.<sup>17</sup>

**Bhalli et al. (2021)** conducted a quasi-experimental study at Combined Military Hospital Rawalpindi, Pakistan, involving 108 patients undergoing elective surgery under general anesthesia. The patients were divided into two groups: Group A received intravenous fentanyl (4 µg/kg), while Group B received intravenous lignocaine (1.5 mg/kg) during anesthesia induction. Hemodynamic parameters, including heart rate, systolic blood pressure, and diastolic blood pressure, were recorded before intubation and at 1, 3, and 5 minutes after intubation. The study found that both fentanyl and lignocaine effectively attenuated the hemodynamic response to laryngoscopy and intubation. However, fentanyl demonstrated better control of heart rate and blood pressure compared to lignocaine. The authors concluded that although both agents are effective, fentanyl provides superior hemodynamic stability during induction of anesthesia.<sup>18</sup>

**Singh et al. (2022)** Conducted a prospective, randomized, double-blind, active-controlled clinical trial involving 90 ASA I and II patients undergoing laparoscopic surgery. The participants were randomly assigned to three groups: Group L received intravenous 2% lignocaine, Group D received dexmedetomidine, and Group C received

normal saline as the control. Postoperative pain was assessed using the **Visual Analogue Scale (VAS)**, while perioperative hemodynamic parameters and opioid consumption were also recorded. The study found that both lignocaine and dexmedetomidine significantly reduced intraoperative fentanyl requirements compared with the control group. Dexmedetomidine provided a longer duration before the first rescue analgesic was required than lignocaine but was associated with a higher incidence of intraoperative bradycardia. The authors concluded that both intravenous lignocaine and dexmedetomidine are effective adjuncts for perioperative pain management, with dexmedetomidine offering prolonged analgesia and lignocaine serving as a safe alternative for postoperative pain control.<sup>20</sup>

**Mishra et al. (2020)** conducted a prospective, randomized, double-blinded clinical study involving 60 full-term pregnant women undergoing elective cesarean section under general anesthesia. The participants were randomly divided into two groups: Group P received intravenous paracetamol (15 mg/kg) and Group N received intravenous nalbuphine (0.2 mg/kg) before induction of anesthesia. Maternal hemodynamic parameters, neonatal APGAR scores, and postoperative pain were assessed using the **Visual Analogue Scale (VAS)**. The study found that nalbuphine provided significantly better attenuation of the maternal hemodynamic response than paracetamol. The time to reach a VAS score of 1 was significantly longer in the nalbuphine group, indicating prolonged postoperative analgesia. Neonatal APGAR scores at 5 minutes were comparable between both groups. The authors concluded that although both nalbuphine and paracetamol are effective for perioperative management, nalbuphine offers superior hemodynamic stability and longer-lasting postoperative analgesia.<sup>21</sup>

**Abdullah et al. (2024)** conducted a prospective, randomized, double-blinded study involving 60 patients undergoing cataract surgery to compare the efficacy of levobupivacaine and lignocaine for peribulbar anesthesia. The participants were equally divided into two groups: Group I received lignocaine with adrenaline, while Group II

received 0.5% levobupivacaine. Intraoperative and postoperative pain, motor and sensory block onset, akinesia score, and duration of analgesia were assessed. The study found that levobupivacaine provided better motor blockade, improved akinesia scores, and lower pain intensity compared with lignocaine. However, there was no significant difference in verbal pain scores between the two groups. The authors concluded that levobupivacaine is more effective than lignocaine for peribulbar anesthesia, providing superior analgesia with fewer complications.<sup>22</sup>

**Sharma et al. (2018)** Conducted a double-blind randomized controlled trial involving 70 ASA I and II patients undergoing elective laparoscopic cholecystectomy. The participants were randomly allocated into two groups: Group I received a single intravenous bolus of lignocaine (2 mg/kg), while Group II received intravenous dexamethasone (0.1 mg/kg) before surgery. Postoperative pain was assessed using the **Visual Analogue Scale (VAS)**, and recovery quality was evaluated using the **Quality of Recovery-40 (QoR-40)** questionnaire. The study found that the dexamethasone group had significantly lower pain scores, reduced postoperative fentanyl consumption, and higher QoR-40 scores compared with the lignocaine group. Patients receiving dexamethasone also demonstrated better physical comfort, independence, and pain relief. The authors concluded that a single preoperative dose of dexamethasone provides better postoperative recovery and analgesia than intravenous lignocaine after laparoscopic cholecystectomy.<sup>23</sup>

**Zhang et al. (2025)** conducted a systematic review and meta-analysis of 18 randomized controlled trials involving 1,056 adult patients to evaluate the efficacy of intravenous lignocaine in attenuating the hemodynamic response to laryngoscopy and tracheal intubation. The included studies compared patients receiving intravenous lignocaine (40 mg fixed dose or 0.5–2 mg/kg) with those receiving no lignocaine before intubation. Hemodynamic parameters, including mean arterial pressure (MAP), heart rate (HR), and adverse events, were assessed. The meta-analysis demonstrated that intravenous lignocaine

significantly reduced the rise in MAP and heart rate associated with laryngoscopy and tracheal intubation compared with the control group. In addition, patients receiving lignocaine experienced fewer perioperative complications. The authors concluded that intravenous lignocaine at a dose of 1–2 mg/kg effectively attenuates the hemodynamic response to tracheal intubation and improves perioperative safety, although its effect on heart rate may vary according to dosage and ethnicity.<sup>24</sup>

**Fernandes et al. (2024)** conducted a literature review to evaluate multimodal analgesia strategies for postoperative pain management in patients undergoing cardiac surgery. The review highlighted that poststernotomy pain typically peaks within **48 hours** after surgery and may contribute to persistent postoperative pain. The authors discussed several multimodal analgesic strategies, including **acetaminophen, gabapentinoids, NMDA antagonists, alpha-2 agonists, intravenous lidocaine, anti-inflammatory drugs, and regional anesthesia techniques**. The review emphasized that an opioid-sparing multimodal analgesia approach may improve postoperative pain control, reduce opioid consumption and opioid-related complications, and enhance recovery and patient satisfaction after cardiac surgery. The authors concluded that multimodal analgesia should be considered an important component of enhanced recovery protocols following cardiac surgery.<sup>34</sup>

**Eisenbraun et al. (2023)** conducted a 2-stage retrospective study involving adult cardiac surgical patients to compare two multimodal analgesic regimens with an opioid-based regimen. The study found that intraoperative opioid consumption decreased from **425 mg OME** with the opioid-only regimen to **150 mg OME** and **230 mg OME** with multimodal regimens 1 and 2, respectively ( $p < 0.001$ ). Predischage opioid use also decreased from **7.5 mg OME** to **5 mg** and **0 mg OME**, respectively ( $p < 0.001$ ). Multimodal regimen 2 significantly reduced pain scores during the first **0–6 hours (estimated difference = -1.5, 95% CI -1.8 to -1.2,  $p < 0.001$ )**. PONV treatment was required in **53%, 64%, and 62%** of patients receiving multimodal regimen 1, opioid-based regimen, and multimodal

regimen 2, respectively. The authors concluded that multimodal analgesic regimens, particularly those incorporating **methadone and dexmedetomidine**, significantly reduced total and predischARGE opioid consumption in cardiac surgical patients.<sup>35</sup>

**Negm et al. (2025)** conducted a prospective, randomized controlled trial involving **60 adult patients** undergoing elective supratentorial craniotomy to compare opioid-sparing multimodal analgesia (MMA) with conventional opioid-based analgesia. The MMA group received preoperative gabapentin, intraoperative dexmedetomidine, postoperative scalp block with bupivacaine, and scheduled intravenous acetaminophen and ketorolac. The study found that VAS pain scores were significantly lower in the MMA group at **1, 2, and 4 hours** postoperatively ( $p = 0.046, 0.039, \text{ and } 0.045$ , respectively). Significant differences in sedation scores were observed at **30 minutes, 1 hour, and 4 hours** ( $p < 0.001$ ), while the MMA group also had a significantly lower frequency of vomiting ( $p = 0.034$ ). The authors concluded that opioid-sparing MMA provided superior postoperative pain control with fewer opioid-related adverse effects and reduced opioid consumption compared with conventional opioid-based analgesia after craniotomy.<sup>36</sup>

**Jannati, M., & Attar, A. (2019)** Conducted a review to examine the role of analgesia and sedation after coronary artery bypass graft (CABG) surgery, focusing on postoperative pain management, assisted respiration, overall postoperative care, and hospitalization. Data were collected from PubMed, Scopus, and Cochrane databases using the search terms "analgesia," "sedation," "coronary artery bypass grafting," "CABG," and "opioids," and studies published between 1988 and 2018 were evaluated. The review found that both opioid and non-opioid analgesics are commonly used to manage postoperative pain but may increase the risk of pulmonary and cardiovascular complications, particularly following thoracic surgery and CABG. Effective pain management depends on accurate pain assessment, appropriate selection of analgesics and sedatives, and careful evaluation of their effectiveness and adverse effects. The authors

highlighted that determining the appropriate dose of analgesics and sedatives remains a major challenge, as excessive use may cause unnecessary side effects. Successful postoperative pain management is achieved when patients experience adequate pain relief and remain comfortable without significant adverse effects. However, the review emphasized that modern pain management approaches, such as patient-controlled analgesia and multimodal analgesic techniques, remain underused, while postoperative pain management continues to rely mainly on a limited range of opioid and non-opioid medications.<sup>37</sup>

**Smith et al. (2021)** conducted a prospective randomized controlled trial involving 50 patients with grade III and IV hemorrhoids who underwent conventional Milligan-Morgan hemorrhoidectomy. The study compared the effectiveness of intravenous paracetamol with that of a continuous infusion of tramadol and ketorolac in managing postoperative pain. Pain intensity was evaluated using the Visual Analogue Scale (VAS) at 2, 12, 24, 36, and 48 hours after surgery. The results revealed that patients treated with tramadol and ketorolac experienced significantly lower pain scores at 12, 24, and 36 hours postoperatively than those who received paracetamol ( $p < 0.001$ ). In addition, a greater proportion of patients in the tramadol-ketorolac group were discharged within 48 hours. The authors concluded that continuous infusion of tramadol and ketorolac provides superior postoperative pain control and is associated with a shorter hospital stay following hemorrhoidectomy.<sup>38</sup>

**Hashem et al., 2019** Conducted a single-blinded randomized controlled trial involving 132 patients with renal and upper ureteral stones undergoing shock wave lithotripsy (SWL). The study compared the safety and efficacy of intravenous pethidine, intravenous ketorolac, and local xylocaine gel as analgesic agents during the procedure. Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), while stone disintegration was evaluated by kidney-ureter-bladder X-ray and ultrasound imaging. The results showed that patients in the xylocaine group experienced

significantly higher pain scores than those in the ketorolac and pethidine groups. Ketorolac demonstrated comparable or better analgesic efficacy than pethidine and achieved better stone disintegration outcomes. The authors concluded that ketorolac is a safe and effective opioid-sparing alternative for pain management during SWL, whereas lidocaine gel should not be used as a sole analgesic agent.<sup>39</sup>

Khajavi et al., 2016 Conducted a randomized, double-blinded clinical trial involving 80 patients undergoing various types of renal surgeries at Sina Hospital in Tehran between 2014 and 2016. The study compared the multimodal analgesic effects of intravenous ketamine and tramadol, both combined with intravenous paracetamol, for postoperative pain management. Following extubation, patients were randomly assigned to receive either intravenous paracetamol (1 g) plus tramadol (0.7 mg/kg) (PT group) or intravenous paracetamol (1 g) plus ketamine (0.5 mg/kg) (PK group). Postoperative pain severity was evaluated using the Visual Analog Scale (VAS), while agitation levels were assessed using the Ramsey Sedation Scale (RSS). Morphine consumption during the first six postoperative hours, hemodynamic parameters, and postoperative complications were also recorded. The results showed that the ketamine-paracetamol group experienced significantly lower pain scores at all assessment time points compared with the tramadol-paracetamol group. Additionally, patients receiving ketamine required less morphine during recovery ( $0.47 \pm 0.94$  mg vs.  $1.50 \pm 1.35$  mg;  $P = 0.001$ ), demonstrated lower agitation scores at 10 and 20 minutes after administration, and had a lower overall postoperative complication rate (20% vs. 53.3%;  $P = 0.007$ ). The authors concluded that intravenous ketamine combined with paracetamol provides more effective postoperative analgesia, reduces opioid requirements, and improves recovery outcomes compared with tramadol combined with paracetamol in patients undergoing renal surgery.<sup>40</sup>

**Imani et al., 2018** Conducted a comparative clinical study involving 132 patients

undergoing emergency or elective cholecystectomy to evaluate the prophylactic analgesic effects of paracetamol and dexmedetomidine on intraoperative hemodynamic control and postoperative pain management. Patients were divided into two groups, with 66 patients receiving dexmedetomidine and 66 patients receiving paracetamol. Postoperative pain intensity was assessed using the Visual Analog Scale (VAS), while hemodynamic parameters, including arterial blood pressure and heart rate, were monitored during recovery and at 4, 12, and 24 hours after surgery. The results showed that the paracetamol group experienced significantly lower pain scores compared with the dexmedetomidine group ( $P = 0.04$ ), required less opioid consumption within 24 hours postoperatively, and had a longer duration of analgesia. Both treatment groups demonstrated similar effects on hemodynamic stability. The authors concluded that paracetamol and dexmedetomidine are effective in maintaining hemodynamic stability and providing postoperative analgesia during laparoscopic cholecystectomy, with paracetamol showing better pain control and opioid-sparing effects.<sup>41</sup>

Sarakatsianou et al., 2023 Conducted a randomized, double-blinded, placebo-controlled clinical trial involving 98 patients undergoing elective laparoscopic cholecystectomy to evaluate the efficacy of intraoperative intravenous lidocaine infusion on postoperative opioid consumption and pain management. Patients were randomized to receive either intravenous lidocaine (1.5 mg/kg bolus followed by a continuous infusion of 2 mg/kg/h) in addition to standard analgesia or placebo. Postoperative opioid consumption was assessed as the primary outcome, while pain scores, shoulder pain incidence, sedation levels, nausea, and intraoperative hemodynamic parameters were also evaluated. The results showed that lidocaine infusion did not reduce postoperative opioid consumption or improve postoperative pain scores compared with placebo. Although lidocaine decreased intraoperative systolic, diastolic, and mean arterial pressure, it had no significant effect on postoperative sedation or nausea rates. The

authors concluded that intraoperative intravenous lidocaine infusion does not provide additional analgesic benefits after laparoscopic cholecystectomy.<sup>42</sup>

Rafiei et al., 2022 Conducted a double-blind randomized controlled trial involving patients undergoing short-duration hand and forearm surgeries to compare the efficacy and safety of intravenous regional anesthesia (Bier block) using lidocaine combined with paracetamol versus lidocaine combined with morphine. Patients were randomly assigned to receive either lidocaine 0.5% plus paracetamol (300 mg) or lidocaine 0.5% plus intravenous morphine (4 mg). The duration of postoperative pain-free period and maximum postoperative pain intensity were assessed using the Visual Analog Scale (VAS). The results showed no significant difference between the paracetamol and morphine groups regarding pain-free duration or mean maximum pain scores. However, severe postoperative pain was significantly more common in the morphine group, while paracetamol demonstrated a better safety profile. The authors concluded that paracetamol is a safer and effective adjuvant to lidocaine for Bier block anesthesia and may be preferred over morphine for short-duration upper extremity surgeries.<sup>43</sup>

### 3.METHODOLOGY

#### 3.1. Research Design

This research were employed cross-sectional observational study to determine and evaluate the efficacy of lidocaine and paracetamol Tramadol in reducing pain following post coronary artery bypass grafting patients

#### 3.2. Clinical Settings

This research was performed at CMA (cardiac intensive care unit) Hospital, Lahore.

#### 3.3. Sample Size

- 52 participant included
- $$n_0 = Z^2 \times p \times (1 - p) / e^2$$
- Where:
  - $Z$  = Z-value (1.96 for 95% confidence)
  - $p$  = estimated prevalence (0.035 for 3.5%)
  - $e$  = margin of error (e.g., 0.05 for  $\pm 5\%$ )

#### 3.4. Sampling Technique

Convenient sampling technique

#### 3.5. Duration of Study

4. months

#### 3.6. Selection Criteria

##### 3.6.1. Inclusion Criteria

- Adult patients (age 30~75years) scheduled for elective, on/off pump CABG
- ASA grade i, ii

##### 3.6.2. Exclusion Criteria

- Patients having severe hepatic/renal impairment, heart failure (EF <25%),
- allergy to study drugs.
- Willing post-operative ventilated patient

#### 3.7. Ethical Consideration

- Participants must be provided with clear and concise information about the study, including its purpose and benefits, and their right to withdraw at any time. The informed consent document should be written in understandable language and address any questions participants may have.
- Confidentiality and Privacy were maintain participant's confidentiality by ensuring all data is anonymized and securely stored.
- The ethical approval was obtained from the Institutional Review Board (IRB) of Superior University before commencing the study. The IRB was review the research proposal to ensure it adheres to ethical guidelines and protects participant rights.

#### 3.8. Data Collection Procedure

Data were collected from the patients using a **structured questionnaire**. The questionnaire was used to obtain relevant patient information and assess postoperative pain. Pain intensity was measured using the **Numerical Rating Scale (NRS)**, in which patients rated their pain on a scale from **0 to 10**, where **0 represents no pain and 10 represents the worst pain imaginable**.

Patients were asked to report their pain intensity at predetermined postoperative time points, particularly during coughing. The NRS

scores were recorded at 0, 3, 6, 9, 12, and 24 hours after surgery. The collected data were documented systematically for each patient and subsequently analyzed to compare pain levels between the study groups.

### 3.9. Data Analysis

The collected data were entered, organized, and analyzed using IBM SPSS Statistics version 26. Descriptive statistics were used to summarize the data, and appropriate statistical tests were applied to compare pain scores between the study groups. The results were presented using tables and graphs for clear interpretation.

## RESULT

A total of 52 patients were enrolled in the study, with 26 patients allocated to each group (lignocaine and multimodal analgesia).

The two groups differed significantly with respect to several baseline characteristics. Patients in the multimodal analgesia group were significantly older than those in the lignocaine group ( $61.69 \pm 10.06$  years vs.  $54.62 \pm 9.80$  years,  $p = 0.013$ ). The gender distribution also differed significantly between groups, with a higher proportion of males in the multimodal analgesia group (73.1%) compared with the lignocaine group (42.3%), while females predominated in the lignocaine group (57.7% vs. 26.9%,  $p = 0.025$ ). Additionally, the prevalence of kidney disease was significantly higher in the multimodal analgesia group (38.5%) than in the lignocaine group (7.7%,  $p = 0.008$ ). In contrast, the two groups were comparable with respect to hypertension (23.1% vs. 42.3%,  $p = 0.139$ ) and diabetes mellitus (15.4% vs. 30.8%,  $p = 0.188$ ). Overall, while several comorbidities were evenly distributed, the two groups were not completely balanced at baseline, differing significantly in age, gender distribution, and prevalence of kidney disease (Table 1).

**Comparison of Postoperative Pain Scores Between Groups** Postoperative pain, assessed using the Numerical Rating Scale (NRS) at rest and during coughing, was compared between the two groups at six time points (0, 3, 6, 9, 12, and 24 hours). For pain scores at rest, no statistically significant differences were observed between the lignocaine and

multimodal analgesia groups at 0 hours ( $p = 0.284$ ), 3 hours ( $p = 0.519$ ), 6 hours ( $p = 0.822$ ), 9 hours ( $p = 0.512$ ), or 24 hours ( $p = 0.196$ ). At 12 hours, however, the lignocaine group demonstrated a significantly lower median NRS score compared with the multimodal analgesia group [2 (IQR 2) vs. 3 (IQR 2),  $p = 0.044$ ]. Similarly, for pain scores during coughing, no statistically significant differences were found at 0 hours ( $p = 0.192$ ), 3 hours ( $p = 0.220$ ), 6 hours ( $p = 0.549$ ), 9 hours ( $p = 0.320$ ), or 24 hours ( $p = 0.194$ ). At 12 hours, the lignocaine group again showed significantly lower pain scores than the multimodal analgesia group [2 (IQR 1.50) vs. 4 (IQR 2.25),  $p = 0.013$ ] (Table 2). Overall, pain scores were largely comparable between the two groups across the postoperative period, with a significant advantage for the lignocaine group confined specifically to the 12-hour assessment, both at rest and during coughing.

**Within-Group Changes in Pain Scores Over Time.** The Friedman test was used to assess whether pain scores changed significantly across the six postoperative time points within each group. In the lignocaine group, NRS scores at rest changed significantly over time ( $\chi^2 = 23.12$ ,  $df = 5$ ,  $p < 0.001$ ), as did NRS scores during coughing ( $\chi^2 = 32.459$ ,  $df = 5$ ,  $p < 0.001$ ). Likewise, in the multimodal analgesia group, NRS scores at rest showed significant variation over time ( $\chi^2 = 29.52$ ,  $df = 5$ ,  $p < 0.001$ ), as did NRS scores during coughing ( $\chi^2 = 28.813$ ,  $df = 5$ ,  $p < 0.001$ ) (Table 3). These findings indicate that postoperative pain scores, both at rest and during coughing, changed significantly across the 24-hour observation period within each treatment group, confirming that the pattern of postoperative pain was not static in either group.

Table 1. Demographic Details

| Characteristic                | Lignocaine (n=26) | Multimodal analgesia (n=26) | p-value |
|-------------------------------|-------------------|-----------------------------|---------|
| Age, years, mean $\pm$ SD     | 54.62 $\pm$ 9.80  | 61.69 $\pm$ 10.06           | 0.013   |
| Gender: Male, n (%)           | 11 (42.3%)        | 19 (73.1%)                  | 0.025   |
| Gender: Female, n (%)         | 15 (57.7%)        | 7 (26.9%)                   | 0.025   |
| Hypertension: No, n (%)       | 20 (76.9%)        | 15 (57.7%)                  | 0.139   |
| Hypertension: Yes, n (%)      | 6 (23.1%)         | 11 (42.3%)                  | 0.139   |
| Diabetes mellitus: No, n (%)  | 22 (84.6%)        | 18 (69.2%)                  | 0.188   |
| Diabetes mellitus: Yes, n (%) | 4 (15.4%)         | 8 (30.8%)                   | 0.188   |
| Kidney disease: No, n (%)     | 24 (92.3%)        | 16 (61.5%)                  | 0.008   |
| Kidney disease: Yes, n (%)    | 2 (7.7%)          | 10 (38.5%)                  | 0.008   |

The two groups differed significantly in age, gender, and prevalence of kidney disease ( $p < 0.05$ ). Hypertension and diabetes mellitus were comparable between the groups, with no

statistically significant differences. Overall, baseline demographic characteristics were not completely balanced between the groups.

Table 2. Comparison of Pain Scores

| Pain assessment / time | Lignocaine, Median (IQR) | Multimodal analgesia, Median (IQR) | p-value |
|------------------------|--------------------------|------------------------------------|---------|
| NRS at rest            |                          |                                    |         |
| 0 h                    | 2 (6)                    | 3 (2)                              | 0.284   |
| 3 h                    | 3.5 (5)                  | 3 (3.25)                           | 0.519   |
| 6 h                    | 2.5 (4)                  | 2 (2)                              | 0.822   |
| 9 h                    | 2 (1)                    | 2.5 (2)                            | 0.512   |
| 12 h                   | 2 (2)                    | 3 (2)                              | 0.044   |
| 24 h                   | 2 (1.25)                 | 2 (1.25)                           | 0.196   |
| NRS during coughing    |                          |                                    |         |
| 0 h                    | 2.5 (4.25)               | 4.5 (2.25)                         | 0.192   |
| 3 h                    | 3.5 (4)                  | 5 (3)                              | 0.220   |
| 6 h                    | 3 (2)                    | 3 (2.25)                           | 0.549   |
| 9 h                    | 2 (4)                    | 3 (1)                              | 0.320   |
| 12 h                   | 2 (1.50)                 | 4 (2.25)                           | 0.013   |
| 24 h                   | 2 (2)                    | 3 (1.25)                           | 0.194   |

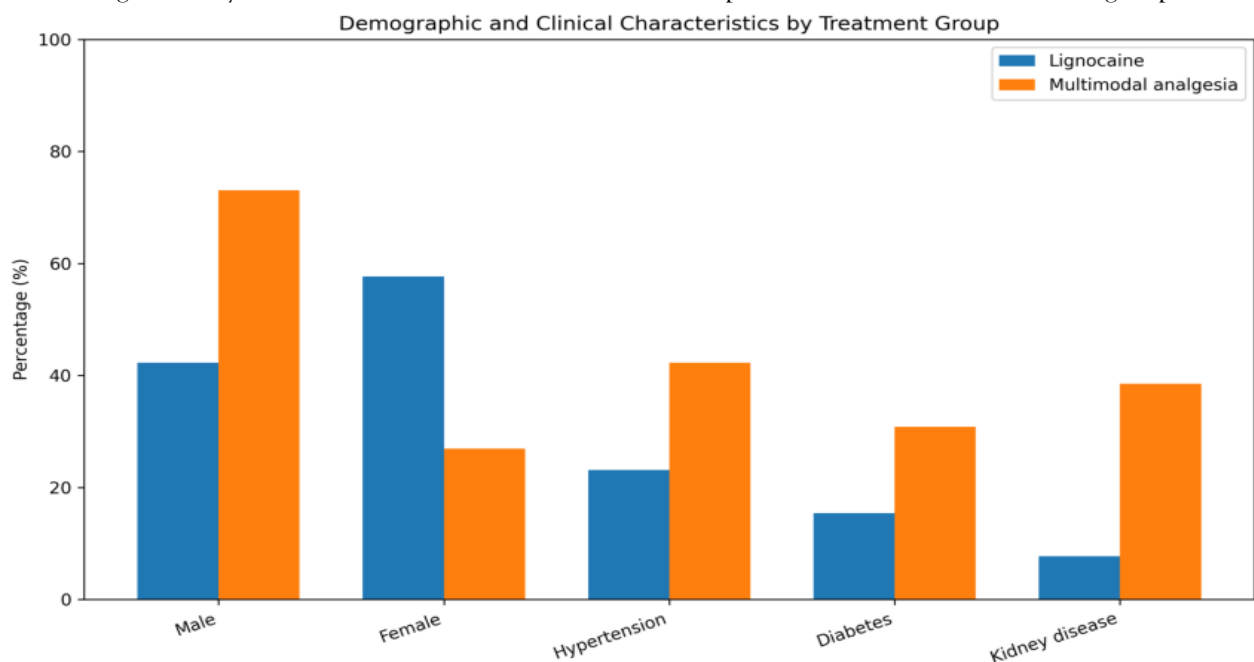
Pain scores were comparable between the groups at most postoperative time points. However, at 12 hours, the lignocaine group had significantly lower NRS scores both at rest ( $p = 0.044$ ) and during coughing ( $p = 0.013$ ).

Thus, lignocaine demonstrated better pain control at 12 hours.

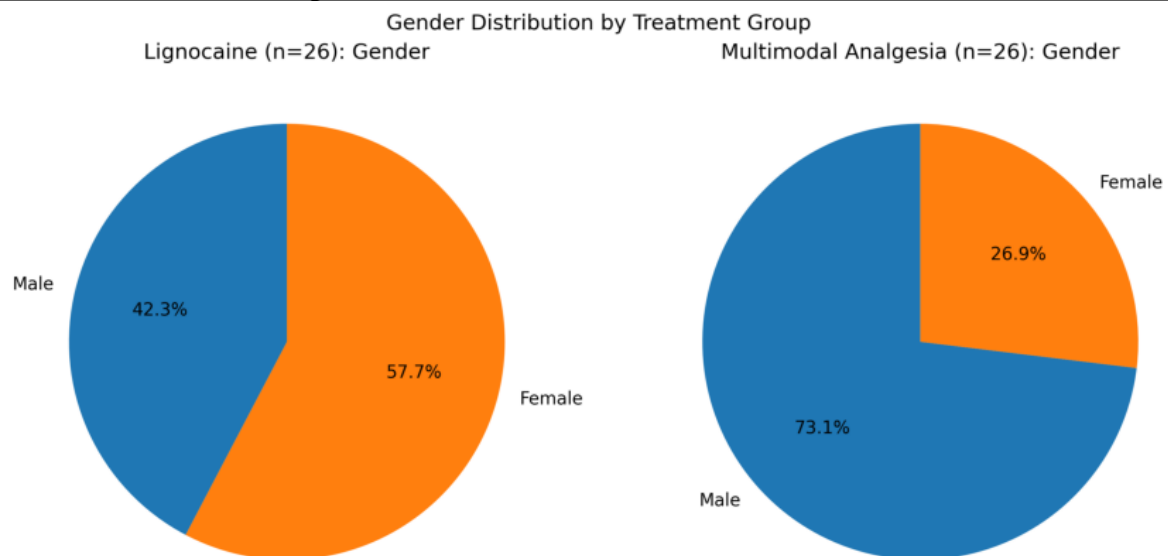
Table 3. Within-Group Friedman Test

| Pain outcome        | Treatment group      | N  | Friedman $\chi^2$ | df | p-value |
|---------------------|----------------------|----|-------------------|----|---------|
| NRS at rest         | Lignocaine           | 26 | 23.12             | 5  | <.001   |
| NRS during coughing | Lignocaine           | 26 | 32.459            | 5  | <.001   |
| NRS at rest         | Multimodal analgesia | 26 | 29.52             | 5  | <.001   |
| NRS during coughing | Multimodal analgesia | 26 | 28.813            | 5  | <.001   |

Friedman's test showed a statistically significant change in NRS scores over time in both groups ( $p < 0.001$ ). This was observed for pain scores both at rest and during coughing. Thus, postoperative pain varied significantly across the six assessment time points in both treatment groups.



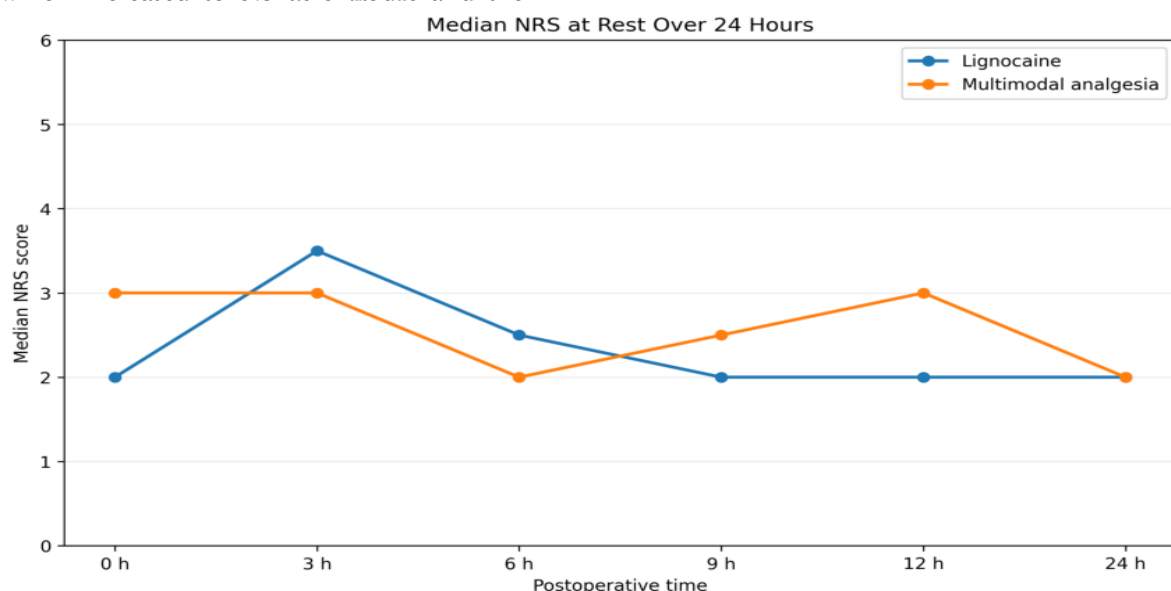
The above figure shows that comorbidity gender wise like hypertension, Diabetes, kidney disease gender-wis



The above figure shows that the lignocaine group total of 26 patient having male 42.3% and female 57.7% while in multimodal analgesia total of 26 patients having 73.1% male and 26 % female

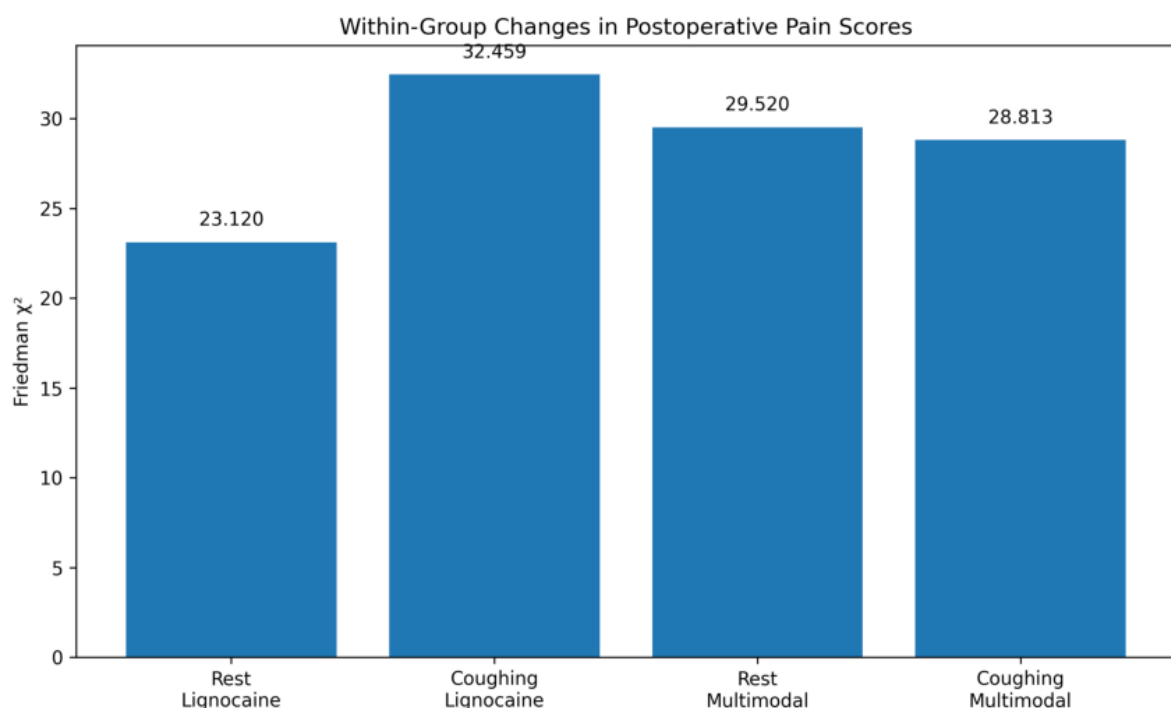
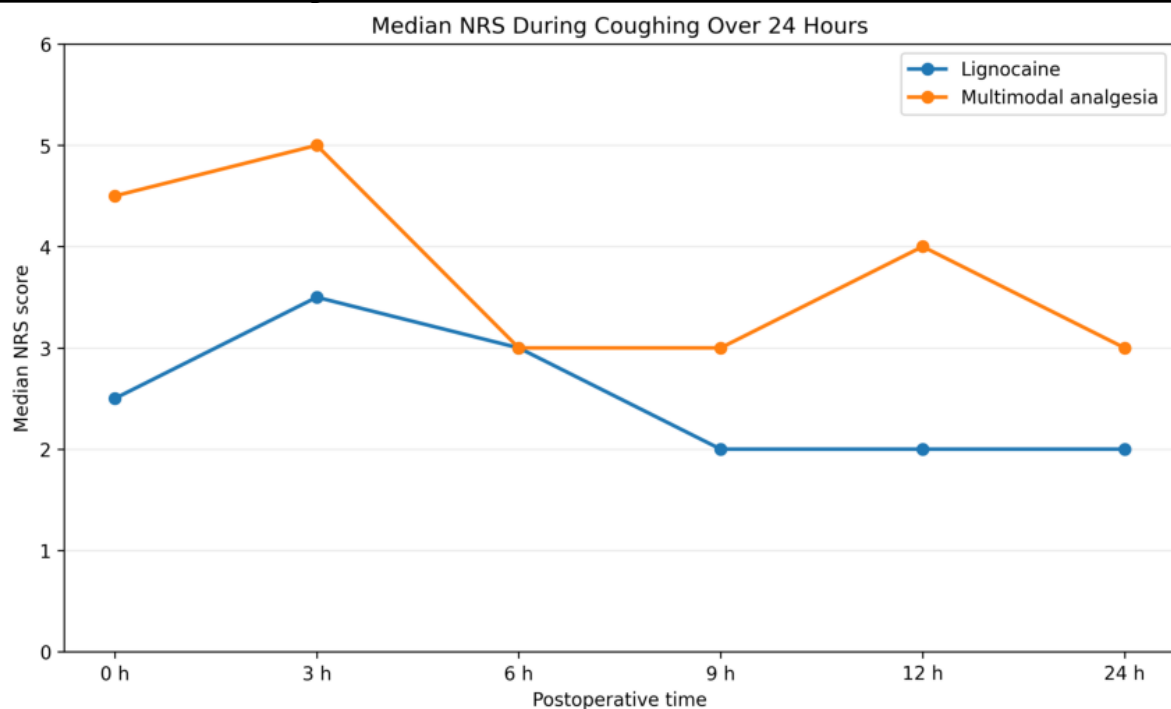
The median NRS pain scores at rest varied between the two groups over 24 hours. The lignocaine group had a score of 2 at 0 hours, which increased to 3.5 at 3 hours and then

decreased to 2 by 9 hours, remaining stable up to 24 hours. The multimodal analgesia group started at 3, decreased to 2 at 6 hours, increased to 3 at 12 hours, and returned to 2 at 24 hours. Overall, both groups showed relatively low and fluctuating pain scores at rest, with **both groups reaching a median score of 2 at 24 hours.**



The lignocaine group showed a gradual reduction in coughing-related pain, from a median NRS of 2.5 at 0 hours to 2 at 9-24 hours. The multimodal analgesia group had higher and more variable scores, ranging from

3 to 5. At 6 hours, both groups had the same median score of 3, while lower pain scores were observed in the lignocaine group at the later time points.



## DISCUSSION

Our observation that lidocaine produced significantly lower pain scores than multimodal analgesia at the 12-hour mark, both at rest and during coughing, is in line with earlier work on the analgesic benefits of perioperative lidocaine. Ustun et al. similarly reported that lidocaine infusion resulted in lower VAS scores at rest throughout the first 24 hours

postoperatively, and lower scores during movement in the early postoperative period and again at 24 hours, when compared with dexmedetomidine and ketamine. Their study also found that patients receiving ketamine required considerably more rescue analgesia on the first postoperative day than those in the lidocaine or dexmedetomidine groups, reinforcing the idea that lidocaine offers a

comparatively stronger analgesic effect. Taken together, these results support what we observed in our own patients: lignocaine provided a measurable advantage over multimodal analgesia at the 12-hour time point. That said, the two studies differ in an important respect. In our cohort, the analgesic advantage of lignocaine reached statistical significance only at 12 hours, whereas Ustun et al. found that lidocaine's benefit persisted for most of the first day and, for some outcomes, extended out to 48 hours. A few factors could account for this. Our comparator arm received a multimodal analgesia regimen rather than dexmedetomidine or ketamine individually, which may itself provide reasonably effective pain control and narrow the gap between groups outside the 12-hour window. Differences in lidocaine dosing or infusion duration between the two protocols, variation in the type or extent of surgery performed, and differences in sample size – and therefore statistical power to detect smaller between-group differences – may also help explain why our significant findings were more time-limited than theirs.

The study by Jain et al., comparing opioid-free anesthesia (OFA) with conventional opioid anesthesia (OA) in abdominal surgeries, adds a somewhat different but relevant dimension to this discussion. Their postoperative VAS scores were significantly lower in the opioid-free group at 0, 2, 4, 6, and 8 hours, indicating an early and fairly prolonged analgesic advantage that persisted through much of the first postoperative day. This contrasts with our findings, where the significant difference between groups emerged only at 12 hours rather than in the immediate postoperative period. One plausible explanation is the difference in intervention type and timing: Jain et al.'s opioid-free protocol combined multiple agents (lignocaine, along with other adjuncts) administered as part of a broader preemptive analgesic strategy beginning intraoperatively, which may account for its more immediate effect on early postoperative pain, whereas our comparison involved a more delayed divergence between groups, potentially reflecting differences in the pharmacokinetics of the specific agents used or in the timing of

drug administration relative to the surgical insult. It is also worth noting that Jain et al. found no significant difference in total postoperative analgesic consumption between their two groups, despite the difference in VAS scores – a pattern that echoes the more restricted (time-limited) nature of the between-group difference we observed. This suggests that even when a favorable postoperative pain trajectory is demonstrated at certain time points, this does not always translate into a proportionate reduction in overall rescue analgesic requirement, a nuance that may be relevant when interpreting the clinical significance of our own 12-hour finding.

The study by Yadava et al. offers a somewhat different but still informative point of comparison, as it examined intraperitoneal instillation of tramadol-bupivacaine versus magnesium sulfate-bupivacaine rather than a systemic lidocaine infusion. Even so, the broader theme is comparable: an adjunct-based analgesic strategy produced consistently lower pain scores than the comparator arm across nearly every assessed time point, from 1 hour through 24 hours postoperatively. Rescue analgesia requirements followed the same pattern, with the magnesium-bupivacaine group both waiting longer before requesting rescue analgesia and consuming less paracetamol overall in the first 24 hours. This mirrors, in principle, what we found with lignocaine – a therapeutic approach that meaningfully reduced pain compared with the alternative regimen – even though the specific agents, routes of administration, and comparator groups differ considerably between the two studies. Where the findings diverge is in the consistency of the analgesic advantage over time. In Yadava et al.'s study, the benefit of magnesium-bupivacaine over tramadol-bupivacaine was statistically significant at essentially every time point measured, from 1 hour out to 24 hours. In contrast, our own results showed a significant between-group difference only at the 12-hour mark, with comparable pain scores at all other time points. This difference may relate to the route and mechanism of drug delivery – intraperitoneal instillation acts locally at the site of surgical trauma and may produce a more sustained

regional effect, whereas systemic lidocaine infusion works through central and peripheral antinociceptive mechanisms that may not translate into as prolonged or uniform an advantage. Differences in the type of surgery (laparoscopic procedures with intraperitoneal instillation versus our surgical setting), dosing regimens, and the specific comparator therapy used in each study likely also contributed to this discrepancy.

The study by Nandi et al., comparing intravenous lignocaine-fentanyl infusion with epidural ropivacaine-fentanyl infusion after major abdominal oncosurgery, offers a somewhat contrasting perspective to our own findings. In their pilot trial, median pain scores on coughing did not differ significantly between groups at any postoperative time point, and overall fentanyl rescue consumption over the first 24 hours was also comparable between the two analgesic strategies. This led the authors to conclude that intravenous lignocaine-based analgesia was equally effective as, rather than superior to, an alternative regimen. This differs from our own findings, where the lignocaine group demonstrated a statistically significant advantage over multimodal analgesia specifically at the 12-hour time point. One possible explanation for this discrepancy is that Nandi et al. combined lignocaine with concurrent fentanyl infusion in both study arms, which may have masked or diluted any independent analgesic contribution of lignocaine, whereas our comparator group received a broader multimodal regimen without a continuous opioid-lignocaine combination. Differences in surgical severity are also relevant, as Nandi et al.'s population underwent major oncologic abdominal surgery with correspondingly higher baseline nociceptive input, which may have required both study arms to rely more heavily on rescue opioids regardless of the baseline analgesic technique, thereby narrowing any measurable between-group difference. Interestingly, Nandi et al.'s findings support the broader principle that intravenous lignocaine infusion can serve as a viable, and comparably effective, alternative to more invasive regional techniques such as epidural analgesia, without a difference in patient satisfaction or adverse

event rates. This reinforces the general safety and feasibility of lignocaine-based analgesic strategies, even though the specific magnitude and timing of its advantage appear to vary depending on the comparator regimen and surgical context, as reflected in the differing results across the studies discussed here

### Conclusion

The present study compared postoperative pain intensity between patients receiving lignocaine and those receiving multimodal analgesia at different postoperative intervals, both at rest and during coughing. Overall, the findings demonstrated that pain scores were similar between the two groups at most of the assessed time points.

A statistically significant difference was observed at 12 hours after surgery, when patients in the lignocaine group reported lower pain scores both at rest ( $p = 0.044$ ) and during coughing ( $p = 0.013$ ) compared with those receiving multimodal analgesia. No statistically significant differences were identified between the groups at the other postoperative assessment points.

The within-group analysis using the Friedman test demonstrated significant variation in pain scores over the six assessment periods in both treatment groups ( $p < 0.001$ ), for pain measured at rest as well as during coughing. This indicates that postoperative pain intensity changed significantly over the course of the first 24 hours following surgery in both groups.

Overall, lignocaine provided postoperative pain control comparable to multimodal analgesia during most of the first 24 postoperative hours. The significant reduction in pain observed at 12 hours suggests a potential analgesic benefit of lignocaine during this period. Nevertheless, because significant between-group differences were not observed consistently across the postoperative assessment period, further adequately powered studies are necessary to determine the effectiveness and clinical relevance of lignocaine for postoperative pain management.

### Limitations

1. **Sample size:** The study involved 52 participants, with 26 patients allocated to each

treatment group. The relatively small sample may have reduced the ability of the study to identify smaller differences between the two analgesic approaches.

2. **Duration of follow-up:** Pain assessment was limited to the first 24 hours after surgery. Consequently, the study could not determine whether the observed analgesic effects were maintained during the subsequent postoperative period.

3. **Pain assessment:** Pain was evaluated using the Numerical Rating Scale (NRS), which is a subjective measure. Individual differences in pain perception, tolerance, emotional state, and previous pain experiences may have influenced the reported scores.

4. **Generalisability:** If conducted at a single centre, the study findings may not be directly applicable to all surgical settings or patient populations. Differences in institutional practices, patient characteristics, and perioperative analgesic protocols may influence the results.

## Recommendations

Based on the findings of this study, several recommendations can be proposed for future research and clinical practice.

1. Future studies should include a **larger number of participants** to improve statistical power and provide more robust evidence regarding the analgesic effects of lignocaine.

2. **Extended postoperative monitoring** is recommended to evaluate whether the effects of lignocaine on pain control continue beyond the initial 24-hour postoperative period.

3. Future research should include assessment of **cumulative opioid consumption**, as a reduction in opioid requirements may provide additional evidence of the opioid-sparing effect of lignocaine.

4. Further studies should evaluate **functional recovery**, including early mobilisation, respiratory function, ability to cough and perform deep breathing, quality of recovery, and length of hospitalisation.

5. Additional **well-designed randomised controlled trials** involving larger and more varied patient populations are warranted to confirm the present findings and further clarify

the role of lignocaine in postoperative pain management.

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