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RESEARCH ARTICLE

ADVANTAGES OF USING DEXMEDETOMIDINE AS AN ADJUVANT IN LAPAROSCOPIC BARIATRIC SURGERIES

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Abstract

The global rise in obesity rates has necessitated an increased frequency of bariatric surgeries, posing intricate challenges in anesthesia management. Dexmedetomidine, an α2-adrenergic receptor agonist, has emerged as a potential adjunct to general anesthesia in this context. This study aimed to evaluate the efficacy and safety of dexmedetomidine in 1306 adult patients undergoing elective bariatric surgery between January 2017 and September 2023, comparing outcomes with a placebo group.Dexmedetomidine was administered during both the maintenance phase of anesthesia. Key parameters including intraoperative and postoperative complications, analgesic requirements, hemodynamics, and recovery profiles were meticulously monitored and analyzed. Dexmedetomidine demonstrated sedative and analgesic-sparing effects, coupled with cardiovascular stabilization and preservation of respiratory function. Notably, it significantly reduced the utilization of anesthetic drugs, postoperative opioids, and propofol during the surgical procedure. Furthermore, dexmedetomidine exhibited efficacy in attenuating propofol injection pain, mitigating stress responses during the critical phase of extubation, and diminishing postoperative pain along with associated analgesic requirements. However, a nuanced approach to dosage was imperative, as higher doses correlated with delayed respiratory recovery and an increased incidence of bradycardia.To summarize, dexmedetomidine as an adjuvant to general anesthesia in bariatric surgery presents notable advantages in enhancing recovery profiles, mitigating complications, and improving patient comfort. Optimal dosing strategies are paramount to harnessing its benefits while mitigating potential adverse effects, thereby optimizing perioperative care in this patient population.

Introduction:-

Bariatric surgeries have now been performed more commonly than ever since the last few decades owing to rapidly growing obesity rates due to diet, lack of exercise, or even stress/emotional factors as well as certain medications, to state the most common reasons out of the innumerable.

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Our study aims to prove that introducing dexmedetomidine as an adjuvant to general anesthesia reduces intraoperative and postoperative complications of bariatric surgery. The anesthesiologists face a challenge while managing anesthesia in individuals who are extremely obese [1]. Previous descriptions of the prevalence of a difficult airway, the danger of aspiration and pulmonary embolus, and the assessment of concurrent diseases in patients who are morbidly obese are well known. Patients who are morbidly obese have a higher incidence of obstructive sleep apnea and lower tissue oxygenation, which raises the possibility of morbidity and mortality from insufficient ventilation [1]. In order to prevent hypoxic episodes, obese individuals are more likely to need postoperative ventilation because they may be more susceptible to the respiratory depressive effects of opioid analgesic medications. It has been suggested that patients who are morbidly obese should avoid opioid medications for analgesia because of the risk of respiratory depression.

This means that in order to provide analgesia during surgery, other medications must be utilized in lieu of opioids [1]. The Federal Drug Administration has approved dexmedetomidine, a selective α2-adrenergic receptor agonist with antinociceptive and sedative effects, in the Anesthesia and Intensive Care Unit (ICU). According to reports, dexmedetomidine reduces the need for anesthetic drugs during surgery, offers analgesia following surgery, and reduces the amount of morphine used in the postanesthesia care unit [1, 2]. Furthermore, little respiratory depression is generated by dexmedetomidine alone [1]. We postulate that administering dexmedetomidine to patients undergoing bariatric surgery, adjuvant to general anesthesia will improve their recovery profile, smooth extubation, reduce the number of postoperative opioids needed, lower the amount of propofol and opioids needed to maintain anesthesia and provide intraoperative control of hemodynamics. Post-bariatric surgery, narcotic-induced postoperative respiratory depression, and hypoxemia can be reduced by receiving dexmedetomidine as an adjuvant to general anesthesia.

Methods:-

1306 adult patients scheduled for elective Bariatric surgery received dexmedetomidine, adjuvant to General Anesthesia between the time period of January 1, 2017, and 14 September 2023, and were compared with the patients that received placebo. Dexmedetomidine was administered during the maintenance phase.

The induction phase includes oxygenation for 3 minutes, followed by midazolam (0.05mg/kg), fentanyl (2mcg/kg), propofol (3mg/kg), rocuronium bromide (0.6mg/kg). Approximately two minutes after these drugs are given IV, the patientis intubated.
The maintenance Phase after the intubation includes; Propofol (1mg/kg/hr) and Dexmedetomidine (0.4mcg/kg/hr) IV infusion along with Sevoflurane gas (MAC = 0.8). The infusion of dexmedetomidine was stopped when the laparoscopic trocars were removed by the surgeon.

Intraoperative and postoperative blood pressure and heart rate were recorded. The total amount ofintraoperative dexmedetomidine and propofol required to maintain anesthesia was measured. Analgesia is given as per the choice of the anesthesiologist, we used paracetamol and NSAIDs. Antibiotics were given as per the choice of the surgeon.

Anesthesia was maintained with propofol and sevoflurane until the surgery was concluded with the infusion stopped after the last suture, and the reversal agents for muscle relaxants were administered. On the basis of 'peripheral nerve stimulation; once a minimum of 80% was achieved on Train-of-Four stimulation, extubation was completed, and; the time taken for extubation was accordingly recorded.

Recovery profile, pain score, and use of patient-controlled analgesia (PCA) were assessed after extubation after shifting the patients to the recovery room.

YEAR	SURGERIES PERFORMED	PATIENTS THAT RECEIVED DEXMEDETOMIDINE	PLACEBO
2017	330	56	274
2018	178	47	131
2019	258	100	158
2020	184	74	110

2021	218	112	106
2022	114	70	44
2023	24	16	08
TOTAL	1306	475	831

Table 1:- Total number of surgeries performed out of which, number of patients that received Dexmedetomidine and the number of patients that did not receive Dexmedetomidine (placebo). Out of the 1306 patients, 475 received Dexmedetomidine while 831 received a placebo, highlighting the comparative groups for the study.

Number of patients	**Obesity + Hypertension**	**Obesity+Diabetes+Hypertension**	**Obesity + Diabetes**	**Only Obesity**	**Average ASA score**
1306	305	207	200	594	2
	Avg Age	**Sex F/M**	**Mean BMI**	**Dex* given**	**Placebo**
	37	F(679)/M(627)	44.5	475	831

Table 2:- Number of patients with co-morbid conditions and their ASA score.

The table represents a comprehensive overview of the details of the distribution of patients with conditions such as obesity with hypertension, diabetes, and both, as well as those with only obesity. The table also presents the average American Society of Anesthesiologists (ASA) score, average age, gender distribution, and mean body mass index (BMI).

Number of Patients	**Received Propofol (placebo)**	**Received Fentanyl adjuvant to Propofol (placebo)**	**Received Remifentanil adjuvant to propofol (placebo)**	**Received Intraoperative Oxycodone with propofol (placebo)**	**Received Intraoperative Dexmedetomidine, with propofol.**
1306	1306 (all patients)	108	563	160	475
	Average Dose of Propofol (placebo)	**Average Dose of Fentanyl**	**Average Dose of Remifentanil**	**Average dose of Oxycodone**	**Average Dose of Dexmedetomidine**
1306	210 mg	144 mcg	700 mcg	6mg	42mcg

Table 3:- Names and Intraoperative doses of maintenance drugs, with the number of patients who received them.

The table highlights the administration of various anesthetic drugs and their combinations with their dosages among the 1306 patients. It includes the number of patients who received propofol, with additional adjuvants like fentanyl, remifentanil, intraoperative oxycodone, and Dexmedetomidine. The table also details the average doses of these drugs, emphasizing the comprehensive approach to anesthesia management in the study. This data is crucial for understanding the comparative effects of Dexmedetomidine versus other anesthetic combinations in bariatric surgery.

Results:-

Average of:	**Heart Rate**	**S.B.P**	**D.B.P**	**Mean B.P**	**Average time taken to complete the surgery.**
Placebo	78	116	78	91	90 minutes
Dexmedetomidine	64	104	60	75	90 minutes

Table 4:-Comparison of intraoperative heart rate and blood pressure values of patients that received dexmedetomidine versus placebo within an average time taken for extubation.

The table presents intraoperative hemodynamic parameters and the time taken to complete the surgery for patients receiving either Dexmedetomidine or a placebo. It includes average heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (BP), and the average duration of the surgery. The data

indicates that patients administered Dexmedetomidine had lower heart rates and blood pressure values compared to those who received a placebo, while the average surgery time remained consistent across both groups.

No. Of Patients (Out of Total =1306)	Placebo (831)	With Dexmedetomidine (475)
Smooth Extubation (%)	36	63
Adequate Breathing (%)	54	84
Spontaneous Respiration (%)	50	78
Average Extubation time (minutes)	14 ± 2	21 ± 2

Table 5;- Comparison of extubation of patients that received dexmedetomidine versus placebo.

The table compares the extubation outcomes between patients who received Dexmedetomidine and those who received a placebo. Key parameters include the percentage of patients experiencing smooth extubation, adequate breathing, and spontaneous respiration, as well as the average extubation time. The data reveals that Dexmedetomidine significantly improved extubation quality, with higher percentages of smooth extubation and adequate breathing, although it also resulted in a slightly longer extubation time compared to the placebo group.

Total Number of Patients	Patients with PONV (%)	Number of Patients that experienced Pain (%)	Average Pain Score (Maximum score = 10)	Number of patients that received opioids for pain (%)	Early Mobilization (%)	Postoperative Mean Blood Pressure (Average)
Placebo	3.5	43	5+	78	33	81 ± 5
With Dexmedetomidine	1.3	27	3+	34	76	67 ± 5

Table 6:- Number of patients with their postoperative outcome.

The data represented in the table examines postoperative outcomes, including the incidence of postoperative nausea and vomiting (PONV), pain experience, average pain scores, the requirement for opioids, early mobilization, and postoperative mean blood pressure. The results show that patients who received Dexmedetomidine experienced lower rates of PONV, reduced pain scores, and a decreased need for opioids. Additionally, these patients had a higher rate of early mobilization and lower postoperative mean blood pressure, indicating an overall better recovery profile compared to those who received a placebo.

The data represented in the above tables clearly highlight that with the exception of time taken for extubation, which is higher in patients who received Dexmedetomidine in comparison with placebo; Dexmedetomidine has shown better results than patients with placebo in all parameters.

Discussion:-

Dexmedetomidine is a highly selective α2-adrenergic receptor (α2-AR) agonist having sedating and analgesic effects, decreased delirium and agitation, perioperative sympatholysis, and cardiovascular stabilizing effects, reduced delirium and agitation, perioperative sympatholysis, cardiovascular stabilizing effects, and preservation of respiratory function [2]. α2-adrenergic receptor (α2-AR) agonists have been successfully used in several clinical settings as stated [2, 3].

When dexmedetomidine is infused intravenously for up to 24 hours, it shows linear pharmacokinetics within the recommended dose range of 0.2 to 0.7 μg/kg/hr. With a distribution half-life of approximately six minutes and an elimination half-life of 2 hours, the distribution phase is completed rapidly. The distribution's steady-state volume is 118 L. The average percentage of binding protein is 94%, which remains constant across all plasma concentrations and shares similarities in both genders. Drugs like fentanyl, ketorolac, digoxin, theophylline, and lidocaine that are

frequently used during anesthesia and in ICU have minimal effect on it in terms of protein binding displacement [2, 4]. The half-lives that are context-sensitive vary from 4 minutes to 250 minutes following an 8-hour infusion. Due to substantial first-pass metabolism, oral bioavailability is low [2, 5].

An article published under The 'BMC Anesthesiology open access journal with the title of "Effects of dexmedetomidine on intraoperative hemodynamics, recovery profile, and postoperative pain in patients undergoing laparoscopic cholecystectomy: a randomized controlled trial" found that intravenous infusion of dexmedetomidine before induction can minimize stress during intubation, pneumoperitoneum, maintain intraoperative hemodynamics more stable, reduce the incidence and severity of cough during extubation, relieve postoperative pain, and decrease both the postoperative analgesic requirements and the incidence of PONV [6]. Following anesthetic withdrawal, recovering from anesthesia frequently causes increased catecholamine concentrations, which are exacerbated by laryngeal irritation during extubation which is counteracted by Dexmetedomindine by reducing sympathetic outflow and noradrenergic activity. Dexmedetomidine, if administered 15 minutes prior to extubation, results in superior attenuation of the airway response to suctioning and laryngoscopy [7]. A titled "Rapid and reliable smooth extubation – Comparison of fentanyl with dexmedetomidine: A randomized, double-blind clinical trial" [7] concluded that after five minutes of medication infusion, dexmedetomidine was shown to cause hypotension, which improved with a fluid bolus but; the heart rate remained constant. Patients in the dexmedetomidine group were reported higher extubation quality. In contrast, individuals in the fentanyl group experienced tachycardia upon extubation and were awake during the procedure [7]. Dexmedetomidine could decrease the occurrence of 'Post-Operative Nausea and Vomiting' (PONV) in adult patients who experience general anesthesia and accelerate postoperative recovery. Thus, Dexmedetomidine can be used as an adjuvant drug for general anesthesia to prevent the development of PONV in clinical practice. However, it is essential to be vigilant with the dose as it might increase the occurrence of bradycardia during surgery [8].

These studies prove the evidence-based validity of our own results which demonstrated that compared to the placebo group, patients who received dexmedetomidine have consistently showed lower heart rates, as well as lower systolic blood pressure (SBP), Diastolic Blood pressure (DBP), and Mean Arterial Pressure (MAP). Similarly, in the group in which dexmedetomidine was administered, the percentage of patients with smooth extubation (without coughing), and adequate depth breathing was higher than the placebo group. Amongst the two groups, dexmedetomidine resulted in a lower percentage of patients with pain experience. Those who did have pain indicated a lower pain score compared to the placebo. Patients also had a lower requirement for opioids; thus resulting in earlier mobilization and controlled post-operative mean blood pressure.

Obesity with its related comorbidities, significantly increases the risk for preoperative, intraoperative, and postoperative surgical complications. Prior to surgery, the majority of problems were related to the respiratory system because obese patients have decreased lung capacity and chest wall compliance in addition to varying degrees of hypoxemia. Intraoperative complications are associated with increased peripheral nerve injuries, thrombotic complications, and difficulties with airway management and fluid administration. Postoperatively, obese patients also exhibit an increased risk of developing myocardial infarctions, wound and urinary tract infections, deep venous thrombosis (DVT), and nerve injuries. There may also be challenges encountered in finding the appropriate drug doses for induction and maintenance in these patients [9]. The patients undergoing bariatric surgery itself put them at a high risk of postoperative nausea and vomiting [10]. These patients can be difficult to intubate, control pain, induce and maintain anesthesia, and oxygenate [11].
As demonstrated in the above studies, which highlighted the efficacy of dexmedetomidine, as well as, the results derived from our patients in this study, we see a decrease in many such hemodynamic instabilities and a decrease in airway management complications; consequently resulting in enhanced recovery.

Conclusion:-

Our study affirms that dexmedetomidine, when used alongside general anesthesia in bariatric surgery, brings significant benefits in improving patient outcomes and safety. Our study, involving 1306 adult bariatric surgery patients, highlights the effectiveness and safety of dexmedetomidine in this setting.

Dexmedetomidine's ability to reduce the need for sedatives and painkillers, stabilize heart and lung functions, and lower post-surgery opioid requirements makes it a valuable addition to bariatric anesthesia protocols. Its capacity to alleviate propofol injection discomfort, manage stress during intubation/extubation, and lessen post-surgery pain and medication needs, further validate its use.

However, cautious dosing is paramount to mitigating potential adverse effects such as delayed respiratory recovery and bradycardia. Optimization of dosing strategies based on individual patient characteristics and surgical requirements is essential for harnessing the full benefits of dexmedetomidine in bariatric anesthesia.

In conclusion, dexmedetomidine stands as a promising adjunct in bariatric anesthesia, offering a multifaceted approach to improving recovery profiles, reducing complications, and enhancing overall perioperative care for obese patients undergoing surgery.

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