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# Dexmedetomidine: A Wonder Drug for Early Ambulation in Morbidly Obese Patients Undergoing Bariatric Surgery

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## Abstract

The pathophysiology of morbid obesity puts the patient at risk for major respiratory and cardiovascular adverse events. The anaesthetic management of morbidly obese patients undergoing bariatric surgery presents a number of challenges including increased risk of post operative opioid related respiratory depression. These patients could benefit from adjunctive analgesics with opioid sparing effects to optimise the perioperative and postoperative pain control. This observational study included 70 morbidly obese patients undergoing laparoscopic sleeve gastrectomy to examine the effect of dexmedetomidine with respect to opioid requirements, haemodynamic response and PONV in morbidly obese patients. Dexmedetomidine decreased the haemodynamic by 30 percent of pre-op values which helped in decreasing the effects of carbo pneumo-peritoneum. Dexmedetomidine statistically decreased the analgesic requirements and PONV. All these lead to early ambulation with all 70 patients ambulating 2 hrs post-surgery. Dexmedetomidine has promising anaesthetic benefits in obese patients undergoing bariatric surgery. It can provide good analgesia and good quality of recovery, reduce the level of stress response in patients and is not associated with an increased risk of adverse events.

**Keywords:** Dexmedetomidine; Morbid obesity; Bariatric surgery, Sleeve gastrectomy; PONV; Ambulation

## Introduction

Obesity is defined as abnormal or excessive fat accumulation that may impair health. BMI is a simple

measure for classifying overweight and obesity in adults: BMI over 25 kg/m$^2$ and exceeding 30 kg/m$^2$ respectively. The WHO categorizes obesity as grade I (BMI 30–34 kg/m$^2$), grade II (BMI 35–39 kg/m$^2$) or grade III / Morbid obesity (BMI at least 40 kg/m$^2$) [1-2]. The rising prevalence of overweight and obesity in a number of countries has been described as a global pandemic [3-5]. Obesity is of major importance because of its association with increased morbidity and mortality [2]. In 2010, overweight and obesity were estimated to cause 3.4 million deaths, 3.9 per cent of years of life lost and 3.8 per cent of disability-adjusted life-years worldwide [1].

Obesity is also complicated by sleep apnoea, impaired reproductive function, hypertension, diabetes, cardiovascular and cerebrovascular diseases, osteoarthritis, and even tumour diseases, posing a serious threat to the physical and mental health of patients [6, 7]. The main stays include controlling diet, strengthening exercise, and drug therapy, yet they are not available to all obese patients. For patients with severe simple obesity and serious complications, surgery is the ultimate method of obesity treatment [8]. Multiple studies with large samples have shown that the most effective modality for the treatment of obesity and its associated diseases is bariatric surgery [6, 7].

Advances in anaesthetic techniques have improved surgical procedures and clinical outcomes [8]. However, anaesthesia can delay the recovery of obese patients with a high prevalence of respiratory conditions and sleep disorders [9]. In addition, the regular perioperative use of opiates in the management of bariatric surgeries has led to side effects, such as sedation, postoperative nausea and vomiting (PONV), respiratory depression, and reduced gastrointestinal motility [10], and these side effects increase the risk of developing cardiac and respiratory complications [11].

Judicious use of anaesthetics is necessary because these drugs increase the risk of complications. Conversely, decreased use of opiates may result in postoperative pain, slowing postoperative recovery [12]. Therefore, we need to minimize opioid use while administering other drugs with analgesic and opioid-sparing effects [13].

Dexmedetomidine is a highly selective α2-adrenoreceptor agonist, which possesses hypnotic, sedative, anxiolytic, sympatholytic, and analgesic properties without producing significant respiratory depression [14, 15]. Its sympatholytic effect decreases mean arterial blood pressure (MAP) and heart rate (HR) by reducing norepinephrine release [16]. In addition, Dexmedetomidine has the ability to reduce both the anaesthetic and opioid analgesic requirements during the perioperative period [17, 18].

**Materials And Methods**

A Prospective study was conducted among 70 consented morbidly obese patients undergoing laproscopic sleeve gastrectomy from April 2018 to April 2019 at Gleneagles Global Hospitals.

**Inclusion Criteria**

1. Morbid obese patients
2. Age group of 18 to 55 years
3. American Society of Anaesthesiologist (ASA) physical status 2 and 3.

**Exclusion Criteria**

1. Patients having severe cardiac disease, neuro disease, severe respiratory lung diseases have been excluded from study.

Pre-operatively, each patient was visited and a written informed consent was taken, after explaining the procedure. Clearance from the institutional ethical

committee was taken before starting the study. Study participants were included in the study by Purposive Sampling technique.

Pre-operative evaluation and all the required routine investigations for the proposed surgery were done. Absolute fasting for at least 8 hours was asked to be done by patients.

After securing IV access cannula, standard ASA monitors which includes Pulse Rate (PR), Non-invasive Blood Pressure (NIBP), Electrocardiogram (ECG), measurements of end tidal gas were connected and base line parameters recorded. Premedication with Inj. Glycopyrrolate 0.005mg/kg IV, Inj. Ondansetron 0.1mg/kg IV was done for the patients, 15 minutes prior to surgery and preoxygenated with 100% Oxygen for 3 minutes. Inj. Propofol 2mg/kg IV was used for induction of anaesthesia, Inj. Fentanyl 2mcg/kg IV was given for analgesia; Inj. Atracurium 0.5mg/kg IV was used for relaxation and an appropriately sized cuffed endotracheal tube was used for intubation. Maintenance of anaesthesia was done with Oxygen:Nitrous Oxide (2:3), Sevoflurane (1-2%) and additional Atracurium was given as deemed necessary.

Perioperative Dexmedetomidine have been started at induction as1mcg/kg over10 min as loading dose and maintained at 0.5mcg/kg/hr as maintenance dose. Perioperative use of morphine is decreased. Haemodynamics, intra-operative and post operative heart rate, [HR and Mean Arterial Pressure], pain scores, VAS scores, intra operative and post operative morphine requirements, Post Operative Nausea and Vomiting (PONV) and recovery phases have been analysed. After return of spontaneous ventilation, residual neuromuscular blockade was reversed with Inj. Neostigmine 0.05mg/kg IV and Inj. Glycopyrrolate 0.01mg/kg IV, and endotracheal tube was removed. The morbidly obese patients were ambulated as early as 2 hours post bariatric surgery due to the decrease opioid use perioperatively.

**Statistical analysis**

The data was collected and compiled in MS Excel. Descriptive statistics has been used to present the data. To analyse the data SPSS (Version 26.0) was used. Significance level was fixed as 5% ($\alpha = 0.05$). Qualitative variables are expressed as frequency and percentages and Quantitative variables are expressed as Mean and Standard Deviation.

**Results**

In the present study, Majority (32.9%) of the study participants belonged to the age group of 21-30 years with the mean age of 34.39±12.132. 77.1% of the study participants were females.

In the present study, the mean pre-operative, intra-operative and post-operative heart rate were found to be 85.33±11.632, 52.51±8.752 and 56.36±9.345 respectively. The mean pre-operative, intra-operative and post-operative systolic blood pressure were found to be 134.00±21.018, 102.90±15.530 and 107.91±14.682 respectively. The mean pre-operative, intra-operative and post-operative diastolic blood pressure were found to be 82.86±11.429, 62.86±12.542 and 70.89±11.641 respectively. There was 24 percent decrease in the heart rate and blood pressure compared to pre op values.

In the present study, the mean VAS score was 0.17+0.380 at ½ hr post-surgery, 0.19±0.392 at 1 hr post-surgery, 1.69±1.161 at 1-1½ hrs post-surgery, 1.80±1.111 at 2 hrs post-surgery and 2.79±1.710 between 4-24 hours post-surgery.

In the present study, there were no vomiting episodes in all the 70 patients. Very few study participants (2.9% at 2

hours, 5.7% at 6 hours and 8.6% between 6-24 hours) developed Postoperative nausea.

**Discussion**

Laparoscopic bariatric surgery is frequently used to treat obesity and metabolic disorders. As a result, anaesthetic drugs and safety issues in the process of surgical treatment of obese patients has received increasing attention. However, obesity is associated with the circulatory and respiratory system of patients and affects the distribution, systemic clearance, and plasma protein binding rate of narcotic drugs, so as to change the pharmacokinetics and pharmacodynamics of narcotic drugs, resulting in dismal postoperative pain relief outcome and surgical treatment [19]. Dexmedetomidine is a lipid-soluble drug with high protein binding rate, which can stabilize hemodynamics, reduce the excessive excitation of the sympathetic nervous system, and play an effective sedative and analgesic effect [20, 21]. More clinical studies have shown that dexmedetomidine also has antianxiety, lowering blood pressure, inhibiting salivary gland secretion, and diuretic effects [22].

Dexmedetomidine produced anaesthetic-sparing effects and a reduction in the need of antiemetic drugs, as well as lower HR, BP values in the early postoperative period in this laparoscopic bariatric surgery patient population. It has been suggested that Dexmedetomidine is a useful alternative to opioid analgesics, despite its high cost because it lacks the respiratory-depressant effects produced by opioid compounds [23, 24]. Studies have shown that α 2 adrenergic receptor agonists may also be useful in the perioperative period because of their sedative/hypnotic, anxiolytic, and sympatholytic properties [25].

The mean age of the present study was comparable with the studies done by Zhang Q et al [26], Zeeni C et al [27] and Khalil BNM et al [28]. The female predominance in the present study was also comparable with the studies done by Tufanogullari B et al [29] and Khalil BNM et al [28]. In a study done by Zhang Q et al [26], 62% of the study participants were males.

The decrease in the HR, BP in the present study is comparable with the studies done by Zeeni C et al [27], Ranganathan P et al [30] and Yun Y et al [31]. Initially, dexmedetomidine acts peripherally on vascular smooth muscle α-2B receptors, resulting in vasoconstriction, transient increases in blood pressure (BP), and reflex decreases in HR mainly seen after rapid administration of large doses. Following this initial peripheral effect, a more gradual central effect results in a decreased sympathetic outflow and circulating catecholamine levels, with an increased vagal activity, causing a decrease in HR and BP [25, 32].

The decrease in the VAS score in the present study is comparable with the studies done by Zhang Q et al [26], Zeeni C et al [27], Ranganathan P et al [30] and Schnabel A et al [33]. Meta-analyses have shown that dexmedetomidine administration significantly decreases postoperative pain and has an opioid sparing effect [34-36]. Following intravenous administration, dexmedetomidine has a rapid distribution phase (6-min distribution half-life) and a terminal half-life of 2 h. Dexmedetomidine is extremely lipophilic and it is likely that, in the morbidly obese patient, it will be taken up by the fatty tissue thereby prolonging its elimination and providing prolonged postoperative analgesia.

Dexmedetomidine also reduces the incidence of opioid-related adverse events (PONV, pruritus, and respiratory depression) [35]. In our study, were no vomiting episodes in all the 70 patients. Very few study participants (2.9% at 2 hours, 5.7% at 6 hours and 8.6% between 6-24 hours)

developed Postoperative nausea. This is comparable with the study done by Zeeni C et al [27], Zhang Q et al [26], Tufanogullari B et al [29] and Khalil BNM et al [28]. The utility of Perioperative dexmedetomidine infusion leading to less need for opioids and earlier discharge, particularly after laparoscopic gastric bypass surgery has been supported by studies done by Dholakia C et al [37] and Bakhamees HS et al [38].

Continuous pumping of dexmedetomidine during the maintenance period of general anaesthesia can maintain the hemodynamic stability of the patient, leading to a manageable maintenance period of anaesthesia without affecting the recovery time of the patient [39]. This suggests that dexmedetomidine can maintain hemodynamic stability in surgical anaesthesia in clinically obese patients, and the effects of different doses of dexmedetomidine are equivalent. The possible explanation is that after dexmedetomidine enters the human body, it can directly act on the locus coeruleus receptors in the brain, thereby exerting significant anti-anxiety, anti-irritability, and sedative effects, which in turn provides a favourable effect for the stability of the patient's hemodynamics. In addition, dexmedetomidine anaesthesia helps reduce the patient's stress response. It might be attributed to the fact that dexmedetomidine is one of the highly selective $\alpha$2 adrenergic receptor ($\alpha$2AR) agonists, which mainly acts on the $\alpha$2AR of the brain and spinal cord, thereby inhibiting neuronal discharge and the release of norepinephrine. It further reduces the response of the sympathetic nervous system and finally exerts sedative, anxiolytic, and analgesic effects [26].

Dexmedetomidine can effectively manage pain in patients with morbid obesity undergoing bariatric surgery. Dexmedetomidine improves clinical outcomes in the intraoperative period. In addition, dexmedetomidine may improve postoperative recovery in terms of sedation and PONV.

**Conclusion**

Dexmedetomidine decreased the haemodynamics by 30 percent of pre op values which helped in decreasing the effects of carbo pnemo-peritoneum. There was statistically significant decrease in VAS SCORE with use of Morphine in the dose of 0.05mg/kg to 0.07mg/kg, thus decreasing the analgesic requirements, there was statistically significant decrease in PONV. All these lead to early ambulation with all 70 patients ambulating 2 hrs post-surgery. Post-op paracetamol 1gm 6th hourly and Inj. diclofenac 75 mg bd dose was administered., with Inj. ondansetron 4mg bd as rescue antiemetic.

**Future Scope:** In future opioid free anaesthesia (OFA) is in study, which will replace the low opioid anaesthesia in bariatric surgery.

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**Legend Tables and Figures**

Table 1: General Patient Characteristics

| Patient Characteristics | | Frequency | Percentage |
|---|---|---|---|
| Age | 17-20 years | 9 | 12.9 |
| | 21-30 years | 23 | 32.9 |
| | 31-40 years | 16 | 22.9 |
| | 41-50 years | 14 | 20.0 |
| | 51-60 years | 7 | 10.0 |
| | >60 years | 1 | 1.4 |
| | Mean ± SD | 34.39±12.132 | |
| Gender | Male | 16 | 22.9 |
| | Female | 54 | 77.1 |

Table 2: Postoperative nausea and vomiting (PONV)

| Postoperative nausea and vomiting | Frequency | Percentage |
|---|---|---|
| 2 hours | 2 | 2.9 |
| 4 hours | - | - |
| 6 hours | 4 | 5.7 |
| 6-24 hours | 6 | 8.6 |

Table 3: VAS score

| VAS score | Mean | SD |
|---|---|---|
| ½ hour | 0.17 | 0.380 |
| 1 hours | 0.19 | 0.392 |
| 1-1 ½ hours | 1.69 | 1.161 |
| 2 hours | 1.80 | 1.111 |
| 4-24 hours | 2.79 | 1.710 |

Figure 1: Heart Rate

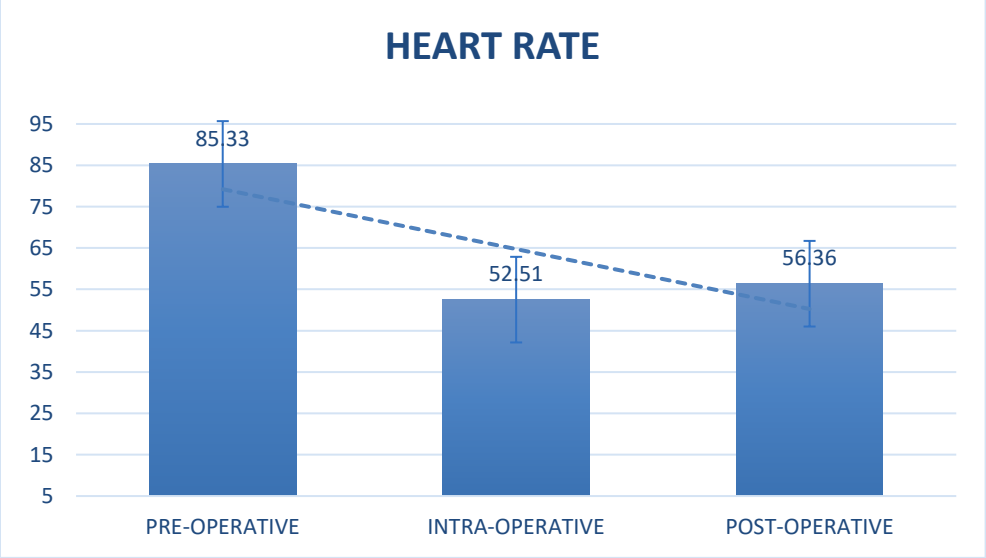


Figure 2: Systolic Blood pressure

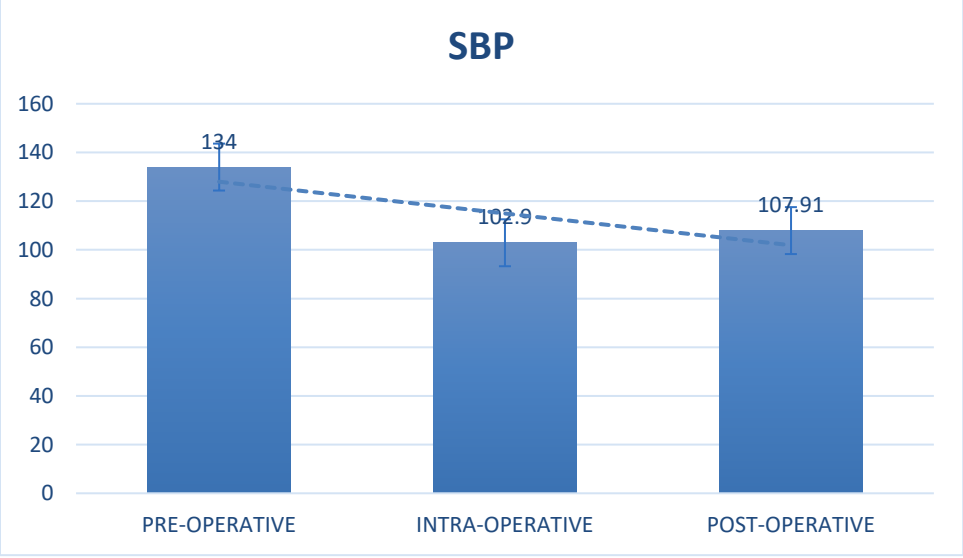

Figure 3: Diastolic Blood pressure

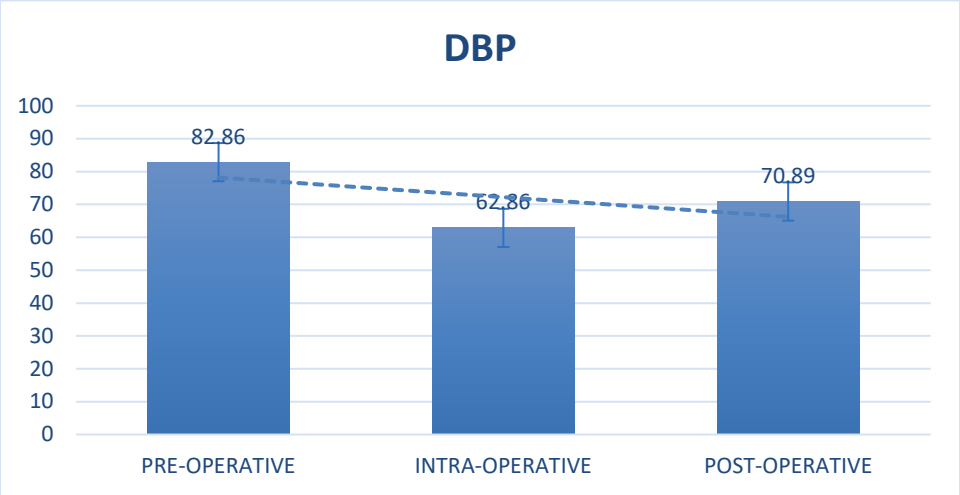


Figure 4: VAS score