

Comparison of Opioid Free General Anaesthesia to Conventional General Anaesthesia for Haemodynamic Stability in Mastoid Surgery: A Randomised Clinical Study

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ABSTRACT

Introduction: Opioids are traditionally used in balanced anaesthesia to provide analgesia and haemodynamic stability; however, opioid-related adverse effects such as respiratory depression, postoperative nausea and vomiting, delayed recovery, and opioid-induced hyperalgesia have prompted the search for alternative strategies. Opioid-Free Anaesthesia (OFA), based on multimodal non opioid analgesia, has emerged as a promising technique to maintain perioperative stability while minimising opioid exposure.

Aim: To compare opioid-free general anaesthesia with conventional fentanyl-based general anaesthesia for perioperative haemodynamic stability in patients undergoing mastoid surgery.

Materials and Methods: This randomised parallel-arm clinical study was conducted in the Department of Anaesthesiology at Government Medical College and SSG Hospital, Vadodara, in collaboration with the ENT department, from September 2023 to July 2024. Patients were randomised into two groups: Group OF received magnesium sulphate and dexmedetomidine with a greater auricular nerve block, while Group O received fentanyl-based anaesthesia. Haemodynamic parameters, Oxygen Saturation (SpO₂), postoperative analgesia duration,

and adverse events were assessed and statistically analysed. Data were analysed using Statistical Package for the Social Sciences (SPSS) software. Normally distributed quantitative variables were analysed using independent samples student t-test between the groups.

Results: The two groups had similar age, gender distribution, ASA physical status, Mallampati grade, body weight, height, and surgical time (p-value >0.05). After induction, Group OF had a significantly lower Heart Rate (HR) (78.98±11.16 bpm) than Group O (89.25±6.52 bpm) (p-value <0.001). In Group OF, Mean Arterial Pressure (MAP) values were continuously lower compared to Group O with significant differences observed at after intubation and various time intervals with significant differences observed at 30 minutes, 120 minutes, and 12 hours postoperatively (p-value <0.001). Both Group OF (329±86.58 minutes) and Group O (330±43.44 minutes) had comparable postoperative analgesia duration, which was not statistically significant (p-value >0.05).

Conclusion: OFA using magnesium sulphate and dexmedetomidine with regional nerve block provides superior haemodynamic stability and comparable postoperative analgesia compared to conventional opioid-based anaesthesia in mastoid surgery.

Keywords: Dexmedetomidine, Fentanyl-based anaesthesia, Magnesium sulphate

INTRODUCTION

Since the beginning of time, opioids have been regarded as an essential component of balanced anaesthesia due to the powerful analgesic effects they possess and their capacity to dampen sympathetic reactions to the stress of surgical procedures. In spite of these advantages, there is a growing body of literature that shows the negative consequences that are associated with opioids. These include respiratory depression, postoperative nausea and vomiting, ileus, drowsiness, opioid-induced hyperalgesia, tolerance, and delayed recovery. Complications like this can make a patient's stay in the hospital longer and have a detrimental impact on the outcomes of the operation [1,2].

OFA, is a multimodal anaesthetic approach that avoids the use of intraoperative opioids while still maintaining acceptable analgesia and anaesthetic depth. This is accomplished through the combined use of non opioid drugs that act on multiple pain pathways. A number of agents, such as non steroidal anti-inflammatory medications, alpha-2 adrenergic agonists, N-methyl-D-aspartate receptor antagonists, local anaesthetics, and regional nerve blocks, are frequently utilised in the process of operative facial amputation. The goal of OFA to deliver effective analgesia while simultaneously

improving haemodynamic stability and reducing side-effects connected to opioids [3,4]. This is accomplished by targeting several mechanisms of nociception.

Magnesium sulphate, which is an antagonist of the NMDA receptor, has the ability to diminish central sensitisation and modify calcium influx, both of which contribute to analgesia and the reduced intensity of stress responses. It has been demonstrated that dexmedetomidine, which is a highly selective alpha-2 adrenergic agonist, can lower the amount of opioids that are required during perioperative procedures. It also has sedative, anxiolytic, and sympatholytic effects without causing respiratory depression. The reduction of afferent nociceptive input is achieved through the utilisation of regional procedures such as the greater auricular nerve block, which further improves postoperative analgesia in otologic surgery [5,6].

The control of intraoperative haemodynamics must be meticulously controlled during mastoid surgery in order to ensure that the surgical field is bloodless and that the settings for the operation are optimal. During laryngoscopy and intubation, conventional opioid-based anaesthesia may be associated with changes in HR and blood pressure. This is especially true during the latter two procedures.

In spite of the fact that OFA has been investigated in the context of abdominal and laparoscopic procedures, there is a scarcity of prospective randomised data that evaluates its utilisation in otologic surgical procedures such as mastoidectomy [7].

There is a lack of data that particularly addresses perioperative haemodynamic stability in mastoid surgery, despite the fact that the existing body of literature demonstrates the benefits of OFA in terms of decreased opiate intake and improved recovery [8-10]. Because there is a gap in the evidence, additional research is required.

Therefore, the purpose of this study was to investigate the efficacy of OFA utilising magnesium sulphate and dexmedetomidine, in conjunction with a greater auricular nerve block, in comparison to the effectiveness of traditional fentanyl-based anaesthesia in patients who were about to have mastoid surgery. The primary objective was to monitor perioperative haemodynamic stability - HR, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and MAP. The secondary objective were to observe postoperative pain relief and postoperative any complication like nausea and vomiting.

MATERIALS AND METHODS

This randomised parallel-arm clinical study was conducted in the Department of Anaesthesiology at Government Medical College and SSG Hospital, Vadodara, in collaboration with the Department of ENT, from September 2023 to July 2024. The study was approved by the Institutional Ethics Committee (IECBHR/204-2023) and registered with the Clinical Trials Registry of India (CTRI/2023/09/057341). Written informed consent was obtained from all participants.

Sample size: Sample size was determined by taking primary reference of annexure from a previous study conducted by Ragupathy R et al., [11]. MAP (opioid) 92.53 and MAP (non opioid) 87.22 by alpha error 5% and beta error 20% sample size in each group came out to be 40, total sample size 80.

Sample size was calculated as below formula:

$$n = (Z\alpha/2 + Z\beta)^2 * (2\sigma^2)/d^2$$

Inclusion criteria: Eighty adult patients aged 18-70 years, of either gender, ASA physical status I-II, scheduled for elective mastoidectomy under general anaesthesia were included in the study.

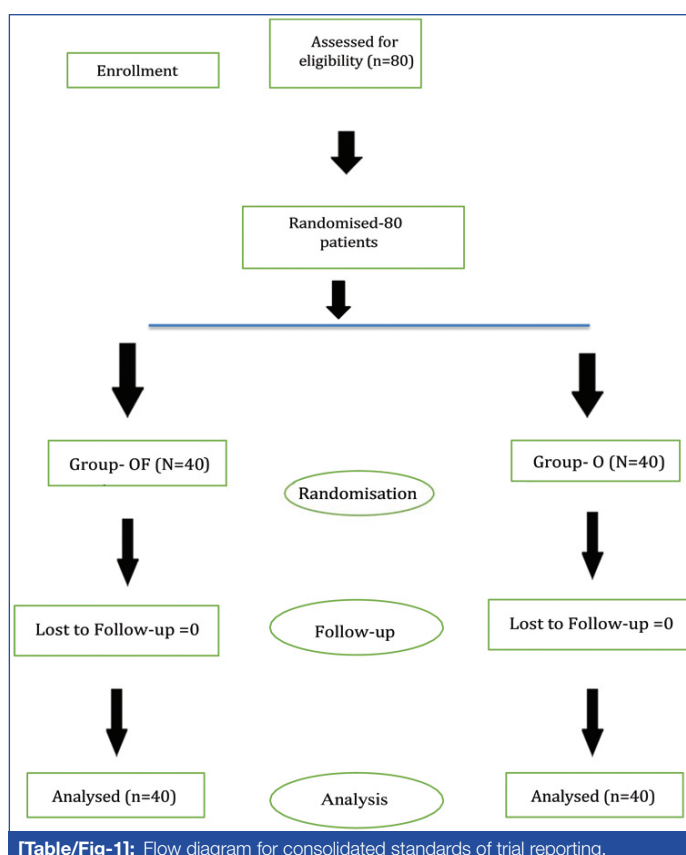
Exclusion criteria: Patients with uncontrolled systemic illness, pregnancy, psychiatric disorders, or allergy to study drugs were excluded from the study.

Randomisation and blinding: A computer-generated random sequence was used for allocation. Participants were enrolled by an independent investigator and assigned to interventions using sealed opaque envelopes. The study was single-blinded, with outcome assessors blinded to group allocation [Table/Fig-1].

Study Procedure

All patients underwent standard preoperative assessment. Premedication included oral pantoprazole (40 mg) and diazepam (10 mg) the night before surgery. The procedure was explained to patients including benefits and complications of each, anaesthesia workstation was checked, airway equipments, monitor, defibrillator, End-tidal carbon dioxide (EtCO₂) and emergency drugs was kept ready before induction. On arrival in the operating theatre, standard monitoring was initiated, and baseline vitals were recorded. All patients received intravenous ondansetron (4 mg), glycopyrrolate (0.2 mg), paracetamol (1 g), midazolam (1 mg), and dexamethasone (8 mg) five minutes prior to induction.

In Group OF (Opioid-Free Anaesthesia), patients received magnesium sulphate 40 mg/kg and dexmedetomidine 1 µg/kg i.v. diluted in 100 mL normal saline over 10 minutes, while in Group O (opioid-based anaesthesia), fentanyl 2 µg/kg i.v. was administered, both prior to induction [12].



[Table/Fig-1]: Flow diagram for consolidated standards of trial reporting.

Patients were preoxygenated with 100% oxygen for three minutes using a tight-fitting face mask. Induction was carried out with injection propofol (2-3 mg/kg) and injection vecuronium (0.1 mg/kg), followed by tracheal intubation with an appropriate-sized ET tube. Anaesthesia was maintained with sevoflurane in oxygen and air, with intermittent doses of vecuronium. Controlled ventilation was provided to maintain EtCO₂ between 30-35 mmHg.

All patients received a landmark-guided greater auricular nerve block after induction [Table/Fig-2], using 5 mL of 0.5% bupivacaine. The injection site was identified along a line joining the mastoid process and the lateral border of the sternocleidomastoid muscle at the level of the cricoid cartilage.



[Table/Fig-2]: Technique of greater auricular nerve block.

Haemodynamic parameters (HR, SBP, DBP and MAP, SpO₂) were recorded at baseline, at intubation, and noted on every 30 mins intraoperatively and postoperatively (up to 24 hours). Supplemental doses of dexmedetomidine (Group OF) or fentanyl (Group O) were administered if HR or MAP exceeded 20% of baseline.

Postoperative analgesia was assessed using the Visual Analogue Scale (VAS). Patients reporting VAS ≥5 received rescue analgesia with i.v. paracetamol 1 g. The duration from drug administration to first rescue analgesia was noted. Adverse events including bradycardia, hypotension, and PONV were recorded and managed appropriately.

STATISTICAL ANALYSIS

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2019) and then exported to data editor page of SPSS version 22.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution. Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5%, respectively.

RESULTS

[Table/Fig-3] shows the comparison of demographic and baseline characteristics between Group OF and Group O. Parameters such as age, gender distribution, ASA physical status, Mallampati grade, body weight, height, and duration of surgery were comparable between the two groups, with no statistically significant differences observed (p-value >0.05). This confirms that both groups were demographically homogeneous and suitable for comparison.

Parameters	Group OF (n=40)	Group O (n=40)	p-value
Age (years)	38.01±12.70	40.60±13.39	0.412
Gender (M/F)	28 / 12	24 / 16	0.341
ASA Grade (I/II)	19 / 21	18 / 22	0.824
Mallampati (I/II/III)	14 / 18 / 8	13 / 19 / 8	0.973
Weight (kg)	55.37±7.86	56.07±8.68	0.684
Height (cm)	146.2±5.08	148.57±6.21	0.091
Duration of surgery (mins)	173.32±36.24	171.75±36.11	0.861

[Table/Fig-3]: Demographic and baseline characteristics of study groups. Statistically significance at p≤0.05; Test applied Chi-square test and Unpaired t-test

[Table/Fig-4] showed mean baseline MAP intraoperatively 30 min, 120 mins, postoperative, 30 mins, 12 hour having p-value <0.001 was statistically highly significant. There was more haemodynamic stability in of group compared to O group. Mean Arterial Pressure (MAP) was significantly lower and more stable in Group OF compared with Group O at selected perioperative intervals, particularly during intubation, 30 minutes, 120 minutes, and immediate postoperative

Time Interval	Groups	Mean±SD	SE of mean	t test value	p-value
Baseline	OF	97.70±9.46	1.49641	0.257	0.798
	O	97.13±10.24	1.61928		
Before intubation	OF	97.91±8.86	1.40092	-0.272	0.787
	O	98.46±9.26	1.46421		
During intubation	OF	93.31±8.60	1.36025	-1.789	0.077
	O	96.84±9.05	1.43105		
After intubation	OF	90.76±8.12	1.28441	-2.581	0.012*
	O	95.71±9.00	1.42411		
Intraoperative 2 mins	OF	86.71±8.02	1.26888	-3.256	0.002*
	O	92.66±8.32	1.31590		
5 mins	OF	86.19±7.69	1.21640	-2.716	0.008*
	O	91.21±8.78	1.38909		
10 mins	OF	85.46±6.49	1.02657	-2.347	0.021
	O	88.98±6.90	1.09146		
20 mins	OF	89.90±7.89	1.24897	-0.504	0.615
	O	90.83±8.60	1.36065		
30 mins	OF	86.71±8.02	1.26888	-3.334	0.001*
	O	92.84±8.42	1.33193		
60 mins	OF	88.24±6.81	1.07696	-1.019	0.311
	O	89.91±7.85	1.24158		
90 mins	OF	88.08±7.72	1.22165	-2.416	0.018*
	O	92.68±9.23	1.46091		

120 mins	OF	86.76±7.95	1.25797	-3.922	<0.001*
	O	94.31±9.21	1.45754		
150 mins	OF	89.44±11.39	1.80186	-2.569	0.012*
	O	95.41±9.26	1.46539		
180 mins	OF	89.84±9.79	1.54914	-2.047	0.044
	O	93.97±8.18	1.29453		
Immediate postoperative	OF	89.89±9.21	1.45627	-3.146	0.002*
	O	96.33±9.07	1.43566		

[Table/Fig-4]: Comparison of Mean Arterial Pressure (MAP) at different time intervals. *Indicate statistically significance at p≤0.05

period (p-value <0.05), indicating better haemodynamic stability in the opioid-free group.

After induction, Group OF demonstrated a greater reduction in HR (78.98±11.16 bpm) compared to Group O (89.25±6.52 bpm), which was statistically significant (p-value <0.001). Changes in HR over time are depicted in [Table/Fig-5].

Time interval	Groups	Mean±SD	SE of mean	t-test value	p-value
Baseline	OF	86.45±10.73	1.69689	0.343	0.657
	O	85.57±12.01	1.90037		
Before intubation	OF	87.45±11.83	1.87150	0.000	0.697
	O	87.45±12.47	1.97288		
During intubation	OF	86.62±12.98	2.05304	-4.482	0.013*
	O	97.75±8.82	1.39539		
After intubation	OF	87.27±11.59	1.83275	-0.298	0.632
	O	88.07±12.41	1.96227		
Intraoperative 2 min	OF	83.85±9.39	1.48520	-5.914	0.130
	O	94.67±6.76	1.06962		
5 mins	OF	84.75±9.31	1.47316	-0.166	0.777
	O	85.10±9.53	1.50801		
10 mins	OF	84.90±7.34	1.16068	-1.095	0.005*
	O	87.27±11.59	1.83275		
20 mins	OF	84.90±9.31	1.47361	0.122	0.105
	O	84.67±7.02	1.11020		
30 mins	OF	83.85±9.39	1.48520	-0.431	0.094
	O	84.65±7.06	1.11663		
60 mins	OF	86.45±10.73	1.69689	0.624	0.013*
	O	85.15±7.65	1.21029		
90 mins	OF	84.65±9.68	1.53069	-0.771	0.065
	O	86.62±12.98	2.05304		
120 mins	OF	84.17±8.87	1.40278	-0.793	0.290
	O	85.62±7.42	1.17435		
150 mins	OF	86.00±9.37	1.48194	5.796	0.068
	O	75.50±6.59	1.04206		

[Table/Fig-5]: Comparison of both Group HR for different time interval. * Indicate statistically significance at p≤0.05

There were no significant differences between both groups in terms of SBP [Table/Fig-6]. Highly significant differences were observed postoperatively at 30 minutes and 12 hours postoperatively (p-value <0.001) [Table/Fig-7].

[Table/Fig-8] presents the comparison of SpO₂ between the two study groups at selected postoperative time intervals. There was no statistically significant differences noted at certain time points.

[Table/Fig-9] compares the mean duration of postoperative analgesia between Group OF and Group O. The duration of analgesia was comparable between the two groups, and the difference was not statistically significant (p>0.05), suggesting that OFA provides postoperative analgesia equivalent to conventional opioid-based anaesthesia in mastoid surgery.

Time Interval	Groups	Mean±SD	SE of mean	t-test value	p-value
Baseline	OF	130.30±14.61	2.31112	0.270	0.835
	O	129.40±15.20	2.40427		
Before intubation	OF	130.85±13.27	2.09870	-0.051	0.677
	O	131.00±13.22	2.09027		
During intubation	OF	125.55±12.39	1.96049	-1.356	0.685
	O	129.45±13.31	2.10492		
After intubation	OF	122.30±12.08	1.91023	-2.066	0.361
	O	128.25±13.63	2.15572		
Intraoperative 2 mins	OF	116.85±10.81	1.70953	-2.765	0.253
	O	124.10±12.57	1.98836		
5 mins	OF	116.50±11.72	1.85327	-2.061	0.225
	O	122.25±13.19	2.08559		
10 mins	OF	116.00±9.39	1.48497	-1.367	0.495
	O	119.05±10.53	1.66562		
20 mins	OF	117.20±11.35	1.79572	-1.575	0.144
	O	121.50±13.00	2.05657		
30 mins	OF	116.85±10.81	1.70953	-1.188	0.906
	O	119.75±11.01	1.74119		
60 mins	OF	118.37±9.02	1.42761	-0.305	0.296
	O	119.05±10.69	1.69159		
90 mins	OF	116.65±11.18	1.76779	-2.502	0.182
	O	123.45±13.05	2.06433		
120 mins	OF	118.70±11.61	1.83631	-2.064	0.194
	O	124.45±13.25	2.09577		
150 mins	OF	119.57±14.49	2.29210	-1.867	0.342
	O	125.20±12.36	1.95501		
180 mins	OF	121.60±12.25	1.93709	-0.498	0.242
	O	123.05±13.76	2.17649		
Immediate postoperative	OF	121.60±13.36	2.11369	-1.362	0.561
	O	125.50±12.20	1.93052		

[Table/Fig-6]: Comparison of both groups SBP for different time interval.

Time Interval	Groups	Mean±SD	SE of mean	t-test value	p-value
Baseline	OF	81.40±7.58	1.19872	0.230	0.916
	O	81.00±7.98	1.26288		
Before intubation	OF	81.45±7.27	1.15022	-0.449	0.857
	O	82.20±7.67	1.21275		
During intubation	OF	77.20±7.20	1.13860	-2.088	0.816
	O	80.55±7.14	1.12998		
After intubation	OF	75.00±6.68	1.05733	-2.926	0.325
	O	79.45±6.91	1.09307		
Intraoperative 2 mins	OF	71.65±7.11	1.12521	-3.497	0.487
	O	76.95±6.42	1.01524		
5 mins	OF	71.05±6.35	1.00508	-3.178	0.489
	O	75.70±6.72	1.06350		
10 mins	OF	70.20±5.59	0.88521	-3.063	0.849
	O	73.95±5.34	0.84577		
20 mins	OF	76.25±8.02	1.26934	0.457	0.234
	O	75.50±6.59	1.04206		
30 mins	OF	71.65±7.11	1.12521	-4.736	0.494
	O	79.40±7.51	1.18797		
60 mins	OF	73.17±7.08	1.12026	-1.413	0.677
	O	75.35±6.67	1.05584		
90 mins	OF	73.80±6.98	1.10430	-2.128	0.508
	O	77.30±7.70	1.21855		

120 mins	OF	70.80±6.92	1.09498	-5.192	0.357
	O	79.25±7.61	1.20403		
150 mins	OF	74.07±10.16	1.60783	-2.785	0.331
	O	79.95±8.63	1.36530		
180 mins	OF	73.62±10.25	1.62224	-3.438	0.211
	O	80.57±7.62	1.20623		
Immediate postoperative	OF	74.05±7.74	1.22472	-4.373	0.355
	O	81.75±8.00	1.26529		
30 mins	OF	71.35±6.13	0.96977	-5.839	0.026*
	O	80.05±7.15	1.13112		

[Table/Fig-7]: Comparison of both Group DBP for different time interval.

* Indicate statistically significance at p≤0.05

Time Interval	Groups	n	Mean±SD	p-value
Baseline	OF	40	98.64±0.56	0.763
	O	40	98.71±0.51	
Before Incubation	OF	40	98.84±0.36	0.772
	O	40	98.75±0.49	
During Incubation	OF	40	98.78±0.47	0.076
	O	40	98.67±0.47	
After Incubation	OF	40	98.77±0.42	0.089
	O	40	98.78±0.41	
Intraoperative 2 mins	OF	40	98.81±0.39	0.098
	O	40	98.80±0.46	
5 mins	OF	40	98.77±0.45	0.657
	O	40	98.81±0.39	
10 mins	OF	40	98.81±0.39	0.087
	O	40	98.70±0.46	
20 mins	OF	40	98.78±0.44	0.618
	O	40	98.78±0.41	
30 mins	OF	40	98.81±0.39	0.433
	O	40	98.68±0.55	
60 mins	OF	40	98.64±0.56	0.311
	O	40	98.74±0.44	
90 mins	OF	40	98.77±0.45	0.231
	O	40	98.65±0.53	
120 mins	OF	40	98.81±0.39	0.654
	O	40	98.81±0.39	
150 mins	OF	40	98.67±0.47	0.456
	O	40	98.72±0.45	
180 mins	OF	40	98.74±0.44	0.087
	O	40	98.82±0.38	
Immediate postoperative	OF	40	98.76±0.42	0.789
	O	40	98.77±0.41	
30 mins	OF	40	98.80±0.39	0.453
	O	40	98.82±0.38	
1 hr	OF	40	98.77±0.45	0.324
	O	40	98.66±0.53	
2 hrs	OF	40	98.64±0.57	0.245
	O	40	98.74±0.43	
4 hrs	OF	40	98.80±0.39	0.456
	O	40	98.68±0.56	
6 hrs	OF	40	98.79±0.44	0.660
	O	40	98.79±0.40	
8 hrs	OF	40	98.77±0.45	0.342

[Table/Fig-8]: Comparison of both group SpO₂ for different time interval.

Statistically significance at p-value ≤0.05

Group	Group OF mean±SD	Group O Mean±SD	p-value
Duration (minutes)	329±86.58	330±43.44	0.921

[Table/Fig-9]: Duration of postoperative analgesia.

*Indicate statistically significance at $p \leq 0.05$

No major intraoperative or postoperative complications such as bradycardia, hypotension, nausea, or vomiting were observed in either group.

DISCUSSION

This study compares opioid-free and opioid-based anaesthesia for mastoid surgery, evaluating intraoperative haemodynamic stability and postoperative analgesia. The current study reveals that HR and DBP are comparable across both groups, with statistically significant changes observed. However, the SBP values did not show significant differences between the groups ($p\text{-value} > 0.05$). Ragupathy R et al., using lignocaine, magnesium, paracetamol with a combination of facial plane block for postoperative pain relief in laparoscopic surgery, while another study by Regis MJR and Mariappan ES used dexmedetomidine, lignocaine, dexamethasone, and ketamine in laparoscopic surgery, observed that intraoperative haemodynamic parameters such as HR, SBP, and DBP did not show a statistically significant difference [11,12] which supports present study findings. A statistically significant difference in MAP was noted in the opioid group. This outcome was not associated with the present study due to the administration of magnesium sulphate and dexmedetomidine in the opioid-free cohort. These medications are sympatholytic, and the application of a pre-emptive greater auricular nerve block mitigated harmful surgical stimulation, leading to enhanced haemodynamic stability in the opioid-free cohort [13].

Hariharan SS et al., using combination of dexmedetomidine and lignocaine in nasal surgery and they observe that lower mean value of MAP in dexmedetomidine group compare to fentanyl group in group dexmedetomidine significant decrease in SBP, DBP from beginning of the procedure to 30 minutes after extubation. Dexmedetomidine group showed better haemodynamic stability than fentanyl group [14], similar results were observed in the present study. These findings suggest that haemodynamic stability with opioid-free drugs depends on the pharmacological properties of the drugs used, the application of regional nerve blocks, and the type of surgery performed [5,7].

The total duration of analgesia was same in Group OF (329±86.58 mins) hour and Group O (330±43.44 mins). There was statistically not significant ($p\text{-value} > 0.05$) difference in total duration of analgesia in comparison of both the groups. Sarma R et al., using magnesium sulphate and dexmedetomidine in breast cancer surgery, observed that duration of analgesia prolongs in opioid free group compare to opioid group [15]. This finding did not correlate with the present study because their sample size was limited compare to the current study.

Growing concerns regarding opioid-related adverse effects on postoperative recovery prompted this investigation. This study demonstrated that OFA, utilising magnesium sulphate and dexmedetomidine combined with a greater auricular nerve block, provides good intraoperative haemodynamic stability and comparable postoperative analgesia to conventional opioid-based anaesthesia in patients undergoing mastoid surgery. Magnesium sulphate, an NMDA receptor antagonist, manages pain by controlling cell calcium entry, preventing sensitisation and hypersensitivity post-injury. Studies show magnesium reduces anaesthetic needs and achieves good haemodynamic stability intraoperatively [16]. Perioperative i.v. magnesium sulphate can reduce vomiting, nausea, shivering, and postoperative analgesic use [17,18]. Dexmedetomidine acts on alpha-2 receptors, reducing postoperative pain and opioid use. It has sedative, anxiolytic, and sympatholytic effects, decreasing anaesthetic and opioid needs without respiratory depression. It reduces stress response during

intubation and extubation and also reduces postoperative nausea and vomiting [4,5,10]. Greater auricular nerve block provides superior postoperative analgesia than systemic analgesics in tympanomastoid surgery, reducing systemic side-effects like nausea and vomiting. Regional anaesthesia surpasses systemic medication by preventing central sensitisation and thus secondary hyperalgesia. It blocks nerve impulses from peripheral nociceptors to the spinal cord. Peripheral nerve blocks, skillfully used with general anaesthesia, have expanded into postoperative and chronic pain management [18]. The greater auricular nerve block further supplemented analgesia and minimised nociceptive input, reducing the need for systemic opioids. The present study did not observed any complication similar finding correlate with Ragupathy R et al., [11].

Limitation(s)

Limitations of this study include the single-centre design, lack of blinding of the anaesthesia team. Further multicentre trials with larger populations and inclusion of long-term outcomes such as recovery time, patient satisfaction, and opioid use patterns could provide more robust data. Overall, the findings support the role of opioid-free multimodal anaesthesia as a safe and effective alternative in mastoid surgery, offering improved haemodynamic stability without increasing adverse events.

CONCLUSION(S)

This randomised clinical study concludes that OFA using magnesium sulphate and dexmedetomidine, in combination with greater auricular nerve block, provides better intraoperative haemodynamic stability compared to conventional opioid-based anaesthesia in mastoid surgeries. The study also concluded that postoperative analgesia was comparable in both the groups. The opioid-free approach was well-tolerated, with no observed complications, and offers a promising alternative for enhancing patient safety and recovery. Implementation of opioid-free multimodal strategies in appropriate surgical settings may contribute significantly in reducing perioperative opioid use and improving outcomes.

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