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Original Research Article

Outcomes with Opioid Based Versus Opioid-Free Anesthesia in Cancer Surgery of Head and Neck

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Abstract:

Background: Opioid-free anesthesia (OFA) involves a combination of methods aimed at minimizing opioid use perioperatively to mitigate opioid-related adverse effects while preserving patient comfort. This study seeks to evaluate and compare the effects of opioid-free anesthesia (OFA) versus opioid anesthesia (OA) in patients undergoing surgical procedures for head and neck cancer.

Materials and Methods: 88 patients scheduled for head and neck cancer surgeries were randomly assigned to two groups: the opioid anesthesia (OA) group and the opioid-free anesthesia (OFA) group (44 each). Patients in the OFA group received intravenous (IV) lignocaine at 1.5 mg/kg, IV dexmedetomidine at 0.5 mcg/kg, and IV ketamine at 0.5 mg/kg. Meanwhile, those in the OA group were administered IV fentanyl at 2 mcg/kg. Hemodynamic parameters were continuously monitored intraoperatively, with post-operative assessments of analgesic use and visual analog scale (VAS) scores for pain conducted over a 24-hour period. Any side effects were also recorded.

Results: Hemodynamic stability, VAS scores, and analgesic requirements were similar between the two groups, showing no statistically significant differences. However, the need for propofol was notably reduced in the OFA group.

Conclusion: The results of this study indicate that the OFA protocol is a safe, effective, and satisfactory approach that could serve as an alternative to opioid-based anesthesia during induction for patients undergoing head and neck cancer surgeries.

Keywords: Head and neck surgery, opioid anesthesia, opioid-free anesthesia.

Introduction

Opioid-free anesthesia (OFA) integrates multiple strategies to minimize or eliminate perioperative opioid administration, thereby aiming to reduce the adverse effects associated with opioids while maintaining patient comfort. The need for OFA gained attention as opioid-related complications escalated, reaching a peak that led to the declaration of an opioid crisis in the United States in 2017. OFA has been applied across various surgical procedures utilizing techniques like regional anesthesia and drugs such as alpha-2 agonists, NMDA antagonists, acetaminophen, and NSAIDs [1-4].

Beyond mitigating opioid-associated adverse effects, OFA has also demonstrated improved postoperative recovery outcomes. For instance, a study by Mullier et al. comparing OFA and opioid anesthesia (OA) in bariatric surgery patients reported enhanced recovery and lower pain scores in the OFA group. Guinot et al. [5] similarly observed that OFA use in cardiac surgery was linked to decreased postoperative morphine requirements, reduced intubation duration, and shorter ICU stays. While OFA has shown success across a range of surgeries, its role in onco-anesthesia remains a topic of ongoing discussion and research [5-7].

Our study aims to evaluate and contrast the effects of OFA and OA in individuals undergoing head and neck cancer surgeries. This study was conducted to compare the intubation response and propofol requirements between the two groups. Additionally, we sought to assess hemodynamic parameters during the intraoperative period, compare analgesic consumption within the first 24 hours post-surgery, and observe for any adverse effects in both groups.

Material and Methods

In this randomized, prospective, double-blinded study, 88 patients scheduled for head and neck cancer surgeries, aged between 18 and 60 years and classified as ASA grade I or II, were included. Exclusion criteria involved any known allergies to the study drugs, patients with bradycardia (heart rate <60/min), surgeries anticipated to last more than five hours, need for postoperative ventilator support, and patient refusal.

The participants were randomly assigned to either the OFA or OA group using computerized randomization. After obtaining informed consent, initiating an intravenous (IV) line, and applying standard monitors, general anesthesia was induced, and the trachea was intubated with an appropriately sized endotracheal tube (ETT).

Both groups received premedication with IV midazolam at 1 mg and glycopyrrolate at 0.2 mg. The OFA group received IV lignocaine at 1.5 mg/kg, dexmedetomidine at 0.5 mcg/kg, and ketamine at 0.5 mg/kg, whereas the OA group received IV fentanyl at 2 mcg/kg. Both groups were induced with IV propofol, and total propofol consumption required for the loss of verbal response was recorded.

Hemodynamic parameters, including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP), were documented preoperatively, during intubation, five minutes post-intubation, every 10 minutes intraoperatively, at the time of extubation, and during the postoperative period. Anesthesia maintenance involved a 50:50 oxygen-nitrous oxide ratio and isoflurane. Both groups received intraoperative IV paracetamol (PCM) at 1 g and dexamethasone at 8 mg. neuromuscular blockade was reversed, and tracheal extubation was performed at the conclusion of surgery.

Postoperative monitoring continued for 24 hours, with IV paracetamol 1 g administered every eight hours. Pain intensity, measured via the visual analog scale (VAS), was assessed at 0, 2, 4, 6, 12, and 24 hours post-surgery. Rescue analgesia with IV tramadol (1 mg/kg in diluted normal saline) was provided if the VAS score exceeded 4. The total tramadol consumption over the 24-hour postoperative period was recorded. Any complications, such as shivering, postoperative nausea and vomiting (PONV), pruritus, and respiratory depression, were also documented.

Results

The administration of propofol was significantly higher in the OA group compared to the OFA group (Table 1). The difference in propofol requirements between the groups was statistically significant ($p < 0.05$), indicating that opioid-free anesthesia required a lower amount of propofol.

Table 1: Requirement of Propofol in study groups

	OA	OFA	P Value
Propofol (ml)	10.25 ± 1.56	7.82 ± 1.70	<0.05

At baseline, the OA group had a significantly lower mean heart rate (80.39 ± 15.15) compared to the OFA group (89.20 ± 16.04), although the difference was not statistically significant ($p = 0.10$). Throughout the study period, no significant differences in heart rate were observed between the two groups at the various time points. These findings suggest that heart rate responses to the anesthesia regimen (opioid or opioid-free) were similar over time (Table 2).

Table 2: Comparison of Heart rate in study groups

Time Point	OA (Mean ± SD)	OFA (Mean ± SD)	p-value
Baseline (Tb)	80.39 ± 15.15	89.20 ± 16.04	0.10
Intubation (Ti)	92.75 ± 16.60	90.20 ± 12.25	0.53
5 minutes	86.99 ± 18.25	85.99 ± 15.05	0.87
10 minutes	88.61 ± 18.00	88.21 ± 12.25	0.99
20 minutes	84.88 ± 16.95	87.54 ± 12.10	0.82
30 minutes	82.31 ± 17.20	88.20 ± 11.96	0.18
40 minutes	86.52 ± 18.95	85.52 ± 12.38	0.72
60 minutes	84.78 ± 15.80	82.38 ± 9.40	0.88
80 minutes	82.82 ± 13.80	86.79 ± 13.10	0.26
90 minutes	81.35 ± 18.35	84.59 ± 11.98	0.60
110 minutes	82.21 ± 16.10	79.55 ± 9.90	0.62
120 minutes	83.45 ± 15.12	78.96 ± 10.05	0.42
130 minutes	84.11 ± 16.95	80.80 ± 8.24	0.81
140 minutes	83.97 ± 16.40	81.15 ± 8.12	0.55
150 minutes	81.64 ± 12.01	78.60 ± 7.20	0.15

Systolic blood pressure measurements showed no significant differences between the OA and OFA groups at baseline or at any time point after intubation (Table 3). Most p-values were greater than 0.05, indicating that systolic blood pressure remained comparable between the two groups throughout the study. Only at the 140-minute time point was the p-value approaching significance (p = 0.07), with the OA group showing a slightly higher systolic pressure.

Table 3: Comparison of Systolic BP in study groups

Time Point	OA (Mean ± SD)	OFA (Mean ± SD)	p-value
Baseline (Tb)	135.22 ± 13.65	136.50 ± 15.60	0.16
Intubation (Ti)	131.85 ± 24.22	139.00 ± 20.98	0.36
5 minutes	123.65 ± 25.30	121.58 ± 18.40	0.35
10 minutes	120.85 ± 23.89	119.15 ± 17.00	0.56
20 minutes	125.89 ± 21.10	122.84 ± 15.00	0.21
30 minutes	131.55 ± 15.50	128.55 ± 14.10	0.99
40 minutes	126.90 ± 15.45	133.95 ± 14.95	0.23
60 minutes	127.89 ± 15.45	130.05 ± 13.55	0.79
80 minutes	128.45 ± 16.15	136.85 ± 24.85	0.32
90 minutes	125.40 ± 16.85	125.95 ± 10.35	0.99
110 minutes	121.65 ± 15.95	127.15 ± 12.10	0.28
120 minutes	126.40 ± 15.00	128.55 ± 13.35	0.98
130 minutes	126.15 ± 16.10	124.90 ± 14.10	0.65
140 minutes	129.95 ± 10.40	126.25 ± 12.55	0.07
150 minutes	125.22 ± 16.05	125.95 ± 12.30	0.86

Similar to systolic blood pressure, diastolic blood pressure did not show significant differences between the OA and OFA groups (Table 4). The p-values across all time points ranged from 0.05 to 0.93. However, at the 80-minute mark, there was a near-significant difference (p = 0.05), with the OFA group exhibiting higher diastolic blood pressure compared to the OA group. This finding, though suggestive, requires further investigation to confirm its clinical relevance.

Table 4: Comparison of Diastolic BP in study groups

Time Point	OA (Mean ± SD)	OFA (Mean ± SD)	p-value
Baseline (Tb)	80.50 ± 8.20	84.10 ± 8.40	0.12
Intubation (Ti)	83.00 ± 14.00	87.20 ± 10.85	0.38
5 minutes	77.45 ± 14.30	79.85 ± 12.05	0.93
10 minutes	78.40 ± 14.65	74.80 ± 11.55	0.51
20 minutes	79.70 ± 15.20	80.45 ± 11.15	0.64
30 minutes	80.25 ± 10.25	84.30 ± 10.55	0.22
40 minutes	82.35 ± 9.60	81.75 ± 10.15	0.91
60 minutes	80.00 ± 10.35	82.00 ± 10.70	0.90
80 minutes	77.90 ± 8.90	82.90 ± 10.00	0.05
90 minutes	77.35 ± 9.05	78.95 ± 11.00	0.64
110 minutes	75.55 ± 9.35	81.20 ± 6.20	0.11
120 minutes	77.35 ± 9.85	77.10 ± 8.20	0.91
130 minutes	79.20 ± 10.20	79.35 ± 11.60	0.45
140 minutes	80.80 ± 7.85	79.20 ± 8.35	0.12
150 minutes	80.20 ± 10.10	76.60 ± 9.20	0.37

Pain scores, assessed at multiple time points, showed no significant differences between the OA and OFA groups (Table 5). The minor fluctuations in pain scores over time were not statistically significant, suggesting that the type of anesthesia did not have a major impact on pain perception within the first 24 hours following surgery. Also, rescue analgesia showed no significant differences between the study groups.

Table 5: Comparison of Pain Score (Visual Analogue Scale) in study groups

Time Point	OA (Mean ± SD)	OFA (Mean ± SD)	p-value
0 hrs	1.68 ± 1.22	1.48 ± 1.11	0.55
2 hrs	1.72 ± 0.95	2.05 ± 0.92	0.34
4 hrs	1.98 ± 1.48	2.00 ± 1.39	0.91
6 hrs	1.74 ± 1.42	1.92 ± 1.51	0.75
12 hrs	1.55 ± 0.82	1.44 ± 0.89	0.87
24 hrs	1.40 ± 0.98	1.56 ± 1.01	0.29

Discussion

The primary goal of anesthesia is to ensure effective pain management during and following surgery. Traditionally, opioids have been a key component of balanced anesthesia due to their potent analgesic properties and their ability to maintain hemodynamic stability. However, as their perioperative use increased, so did the awareness of their associated adverse effects. Reducing or eliminating opioid use may potentially enhance postoperative recovery by minimizing these complications. An 'opioid paradox' phenomenon has been observed, wherein patients who receive opioids intraoperatively may require higher doses postoperatively due to opioid receptor sensitization, tolerance, and resulting hyperalgesia [8].

Our findings indicate a statistically significant reduction in propofol requirement in the non-opioid group, consistent with the observations of Pierre-Grégoire Guinot's study in cardiac surgery [5]. Although Guinot's study retrospectively noted shorter intubation times, our results further substantiate that non-opioid regimens, when combined with synergistic sedative agents, clearly reduce the need for propofol.

We compared heart rate and blood pressure from intubation to five minutes post-intubation. No statistically significant differences were observed between the two groups (P>0.05), aligning with Jan P. Mulier et al.'s findings [7], which also reported no significant hemodynamic disturbances, such as bradycardia, hypotension, tachycardia, or hypertension (defined as deviations of more than 20% from baseline values).

Heart rate, systolic and diastolic blood pressures, and mean arterial pressure showed no statistically significant differences (P>0.05) across groups, echoing the findings of Mulier et al. [7], who similarly reported minimal hemodynamic variability.

Postoperative pain over 24 hours was assessed using the Visual Analogue Scale (VAS), with scores above 4 indicating the need for rescue analgesia (tramadol at 1 mg/kg). Our results showed comparable VAS scores between the groups, with no statistically significant difference in analgesic consumption (P>0.05). This contrasts somewhat with studies by Mullier [7], Guinot [5], and Hontoir [9], which reported improved analgesia and patient comfort in opioid-free anesthesia groups. Nonetheless, our study suggests that non-opioid alternatives may adequately replace opioids for pain management in head and neck surgeries.

Common side effects such as nausea and vomiting were absent, likely due to pre-extubation administration of 8 mg ondansetron IV. No cases of postoperative shivering, allergic reactions, or other adverse effects were observed in either group. Similar results were reported by previous researchers [10-13].

Limitations:

4 patients, 2 from each group, were excluded from the study due to the development of intolerable postoperative pain, necessitating the use of morphine for pain management. During the assessment of propofol requirements and intubation responses, certain cases were excluded due to difficult intubation in head and neck oncosurgical patients, which required 2 or more attempts. Follow-up was not conducted for a minimum of 7 days, which could have provided additional insights into recovery outcomes and potential unknown side effects. The study population was limited, focusing only on head and neck surgeries. Further studies in oncology surgeries are needed to draw definitive conclusions.

Conclusion

This study demonstrated that the OFA regimen required significantly less propofol for induction compared to the OA regimen, while maintaining comparable hemodynamic stability during both intraoperative and postoperative phases. Postoperative pain scores were also similar between the two groups, with no statistically significant differences observed. These findings indicate that the OFA protocol is a safe, effective, and satisfactory alternative to opioid use during induction for patients undergoing head and neck cancer surgeries.

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