RESEARCH PAPER

Effectiveness of Fentanyl-Soaked Nasal Packs in Postoperative Pain Management Following Nasal Surgeries: A Prospective Randomized Controlled Trial

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ABSTRACT

Background: Postoperative pain following nasal surgeries is often exacerbated by nasal packing. Although intranasal fentanyl has demonstrated analgesic potential, evidence from adequately powered randomized trials across diverse nasal procedures remains limited. ***Objective:*** To evaluate the efficacy and safety of fentanyl-soaked nasal packs in reducing postoperative pain and systemic opioid requirement following nasal surgeries. ***Methods:*** In this prospective, randomized, double-blind controlled trial, 192 adult patients undergoing septoplasty, functional endoscopic sinus surgery (FESS), or combined procedures were allocated to receive either fentanyl-soaked (50 µg) or saline-soaked nasal packs. Pain intensity was assessed using the Numeric Rating Scale (NRS) [17,18], and patient satisfaction (SAT) was recorded at predefined postoperative intervals. Secondary outcomes included sedation (Ramsay Sedation Scale) [19], hemodynamic parameters, adverse events, and rescue analgesic requirement. ***Results:*** The fentanyl group demonstrated significantly lower NRS scores at all postoperative time points ($p < 0.001$) and higher patient satisfaction scores ($p < 0.05$). The requirement for rescue tramadol was significantly reduced (22.9% vs. 67.7%, $p < 0.001$), indicating a substantial opioid-sparing effect. A transient, mild increase in sedation was observed at 3 hours without clinical compromise. No significant differences in hemodynamic parameters or serious adverse events were noted between the groups. ***Conclusion:*** Fentanyl-soaked nasal packing provides effective and safe postoperative analgesia, significantly reduces systemic opioid requirement, and improves patient satisfaction. This simple, non-invasive technique may serve as a valuable opioid-sparing component of multimodal analgesic strategies in nasal surgery.

Keywords: Intranasal fentanyl; nasal packing; postoperative pain; septoplasty; functional endoscopic sinus surgery (FESS); opioid-sparing analgesia.

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INTRODUCTION

Postoperative pain following nasal surgeries, such as septoplasty and functional endoscopic sinus surgery (FESS), remains a prevalent and often undertreated clinical challenge [1,2]. The discomfort arises not only from surgical trauma to the mucosa and underlying structures but is also significantly exacerbated by the presence of nasal packing, which is routinely used for hemostasis and structural support [3,4]. Inadequate pain control in the postoperative period may lead to increased patient anxiety, delayed mobilization, prolonged hospital stay, and overall dissatisfaction with surgical care [1,5].

Conventional management strategies predominantly rely on systemic analgesics, including oral or intravenous non-steroidal anti-inflammatory drugs (NSAIDs) and opioids. However, systemic opioid use is associated with a well-documented spectrum of adverse effects, including nausea, vomiting, respiratory depression, sedation, constipation, and the potential for misuse [6]. These limitations have prompted the search for targeted, opioid-sparing analgesic approaches that can provide effective pain relief while minimizing systemic exposure.

Fentanyl, a potent synthetic µ-opioid receptor agonist, possesses pharmacokinetic properties that make it particularly suitable for localized administration. Its high lipophilicity, rapid onset of action, and avoidance of hepatic first-pass metabolism when delivered via the nasal mucosa enable effective analgesia at relatively

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low doses with reduced systemic side effects [7,8,9]. Furthermore, the intranasal route represents a non-invasive and practical method of drug delivery that does not require active patient participation, unlike intravenous patient-controlled analgesia (PCA) [10,11].

Previous studies have demonstrated the efficacy of intranasal fentanyl in various clinical settings, including breakthrough cancer pain and acute pain management in emergency care [12,13,14]. In otorhinolaryngology, emerging evidence suggests that fentanyl-soaked nasal packing may improve postoperative pain control following procedures such as septoplasty and nasal bone fracture reduction [15,16]. However, most of these studies are limited by relatively small sample sizes or focus on a single surgical procedure, thereby restricting the generalizability of their findings.

In this context, the present study was designed to evaluate the efficacy and safety of fentanyl-soaked nasal packing in a larger cohort of patients undergoing different types of nasal surgeries, including septoplasty, FESS, and combined procedures. In addition to assessing postoperative pain and patient satisfaction, the study also aimed to evaluate the opioid-sparing potential of this intervention while ensuring that it does not increase the risk of sedation or hemodynamic instability.

MATERIALS AND METHODS STUDY DESIGN AND SETTING

This prospective, parallel-group, double-blind, randomized controlled trial was conducted in the Department of Otorhinolaryngology–Head and Neck Surgery at a tertiary care center in North India. The study protocol was approved by the Institutional Ethics Committee, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Study Population and Sample Size

Adult patients (≥18 years) with American Society of Anesthesiologists (ASA) physical status I or II, scheduled for elective nasal surgery (septoplasty, functional endoscopic sinus surgery [FESS], or combined septoplasty with FESS) under general anesthesia, were screened for eligibility.

The sample size was calculated based on a pilot study and previous literature [15]. Assuming a mean difference of 1.5 in Numeric Rating Scale (NRS) scores between groups, with a standard deviation (SD) of 2.0, an alpha error of 0.05, and a power of 90%, a minimum of 86 patients per group was required. To account for a potential 10% dropout rate, 96 patients were enrolled in each group, resulting in a total sample size of 192 patients.

Inclusion Criteria

1. Age ≥18 years
2. Patients scheduled for elective septoplasty, FESS, or combined procedures under general anesthesia
3. Willingness and ability to provide written informed consent
4. ASA physical status I or II

Exclusion Criteria

1. Revision nasal surgery
2. Surgery performed under local anesthesia or sedation
3. Known hypersensitivity or contraindication to fentanyl or other opioids
4. History of chronic opioid use, substance abuse, or alcohol dependence
5. Clinically significant hepatic, renal, cardiovascular, or neurological disease affecting opioid or pain metabolism
6. Coagulopathy or bleeding diathesis
7. Pregnancy or lactation
8. Inability to comprehend or use pain assessment scales

Randomization and Blinding

Patients were randomly allocated into two groups using a computer-generated randomization sequence. Allocation concealment was ensured using sequentially numbered, sealed, opaque envelopes prepared by an independent investigator not involved in patient care.

The study was double-blinded. The nasal packs were prepared by an anesthesiologist who was not involved in postoperative assessment. Both the patients and the outcome assessors were blinded to group allocation.

Intervention

- **Fentanyl Group:** Following achievement of surgical hemostasis, two standard 8 cm Merocel nasal packs were soaked in a solution containing 50 µg of injectable fentanyl citrate diluted in 2 mL of 0.9% saline and inserted into the nasal cavities as per standard protocol.
- **Control Group:** Identical Merocel packs were soaked in 2 mL of 0.9% isotonic saline and inserted in a similar manner.

Perioperative Management

All patients received a standardized general anesthetic protocol, including induction with propofol (2 mg/kg) and fentanyl (2 µg/kg), neuromuscular blockade with vecuronium, and maintenance with isoflurane in a mixture of oxygen and nitrous oxide. Intraoperative analgesia was supplemented as required.

At the conclusion of surgery, residual neuromuscular blockade was reversed, and patients were extubated upon meeting standard criteria. All patients received intravenous paracetamol 1 g at the end of surgery as baseline analgesia.

Postoperatively, rescue analgesia was administered with intravenous tramadol 50 mg when the NRS score was ≥4.

Outcome Measures

Postoperative assessments were performed at 1, 3, 6, 12, 24, and 36 hours following extubation. Nasal packs were removed at 72 hours postoperatively as per institutional protocol.

Primary Outcomes

- Pain Intensity: Assessed using the 11-point Numeric Rating Scale (NRS; 0 = no pain, 10 = worst imaginable pain) [17,18]
- Patient Satisfaction: Measured using a 10-point satisfaction score (SAT; 0 = completely dissatisfied, 10 = completely satisfied)

Secondary Outcomes

- Sedation Level: Evaluated using the Ramsay Sedation Scale (RSS: 1 = anxious/agitated, 2 = cooperative/oriented, 3 = responsive to commands, 4 = asleep with brisk response, 5 = asleep with sluggish response, 6 = unarousable) [19]
- Hemodynamic Parameters: Non-invasive blood pressure (systolic and diastolic), heart rate, and respiratory rate
- Adverse Events: Including nausea, vomiting, pruritus, headache, sore throat, dizziness, and respiratory depression (defined as respiratory rate <8/min or SpO_2 <92% on room air)
- Rescue Analgesic Requirement: Total dose and number of tramadol boluses required during the first 36 postoperative hours

Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 29.0. Normality of distribution was assessed using the Shapiro–Wilk test.

Continuous variables are presented as mean ± standard deviation (SD) or median (interquartile range), as appropriate, while categorical variables are expressed as frequencies and percentages.

Intergroup comparisons for continuous variables were performed using the independent samples t-test or Mann–Whitney U test, as appropriate. Repeated measures (NRS scores, satisfaction scores, and hemodynamic parameters over time) were analyzed using two-way repeated-measures analysis of variance (ANOVA). Categorical variables were compared using the Chi-square test or Fisher's exact test.

A p-value of <0.05 was considered statistically significant.

RESULTS

Patient Recruitment and Baseline Characteristics

Between August 2022 and August 2024, a total of 235 patients were assessed for eligibility. Of these, 43 were excluded (28 did not meet inclusion criteria and 15 declined participation). The remaining 192 patients were randomized equally into two groups. All participants completed the 36-hour follow-up and were included in the final analysis.

Baseline demographic and clinical characteristics, including age, gender, ASA physical status, type of surgery, and duration of surgery, were comparable between the two groups (p > 0.05), indicating successful randomization (Table 1).

Table 1. Baseline demographic and clinical characteristics of the study population

Characteristic	Septoplasty	FESS	Septoplasty with FESS			
	Fentanyl (n=32)	Control (n=32)	Fentanyl (n=32)	Control (n=32)	Fentanyl (n=32)	Control (n=32)
Gender (Male)	22	28	16	18	23	16
Gender (Female)	10	4	16	14	9	16
Age (years, mean ± SD)	21.56 ± 4.08	25.19 ± 6.50	32.80 ± 13.41	33.13 ± 18.03	28.06 ± 10.13	27.13 ± 9.13
Systemic hypertension, n (%)	0	0	2 (6.3)	2 (6.3)	0	0
Diabetes mellitus, n (%)	0	0	0	6 (18.8)	0	0

Primary Outcomes

Pain Scores (NRS)

Patients in the fentanyl group demonstrated significantly lower postoperative pain scores at all assessment time points compared to the control group (p < 0.001 for all comparisons using two-way repeated-measures ANOVA). The difference was most pronounced during the early postoperative period, particularly at 3 and 6 hours.

This reduction in pain scores was consistently observed across all surgical subgroups, including septoplasty, FESS, and combined procedures (Table 2, Figure 1).

Table 2. Comparison of postoperative pain scores (NRS) between fentanyl and control groups

Time (hours)	Sep-Fentanyl	Sep-Control	p-value	FESS-Fentanyl	FESS-Control	p-value	Sep+FESS-Fentanyl	Sep+FESS-Control	p-value
1	5.00 ± 0.00	6.44 ± 0.50	<0.001	4.00 ± 0.00	5.88 ± 0.34	<0.001	4.19 ± 0.40	6.00 ± 0.00	<0.001
3	4.75 ± 0.44	6.00 ± 0.00	<0.001	4.00 ± 0.00	5.06 ± 0.25	<0.001	4.00 ± 0.00	5.56 ± 0.50	<0.001
6	3.94 ± 0.25	5.00 ± 0.00	<0.001	3.06 ± 0.25	4.56 ± 0.50	<0.001	3.50 ± 0.51	4.88 ± 0.34	<0.001
12	3.06 ± 0.25	4.25 ± 0.44	<0.001	2.38 ± 0.49	3.75 ± 0.44	<0.001	2.99 ± 0.25	4.06 ± 0.25	<0.001
24	2.13 ± 0.49	3.06 ± 0.56	<0.001	1.81 ± 0.40	2.69 ± 0.47	<0.001	2.09 ± 0.30	3.13 ± 0.34	<0.001
36	1.25 ± 0.44	1.69 ± 0.47	<0.001	1.00 ± 0.00	1.44 ± 0.50	<0.001	1.16 ± 0.37	1.63 ± 0.61	<0.001

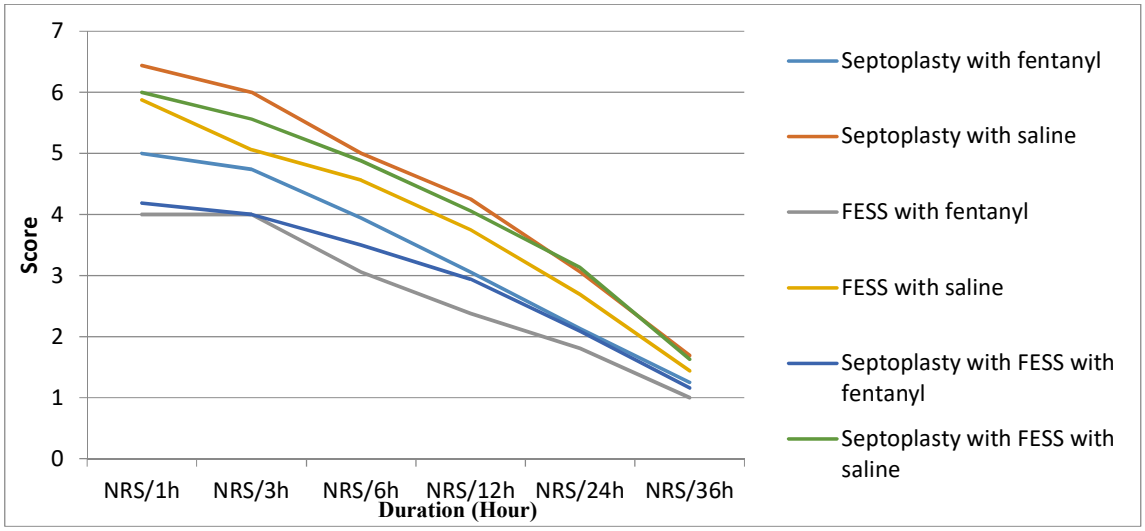

Fig. 1: The Numeric Rating Score between the fentanyl group and the saline group at different time intervals

Patient Satisfaction (SAT)

Patient satisfaction scores were significantly higher in the fentanyl group at all postoperative time points ($p < 0.05$). At 24 hours, the median satisfaction score was 8 (IQR 7–9) in the fentanyl group compared to 5 (IQR 4–6) in the control group ($p < 0.001$).

This improvement in satisfaction paralleled the observed reduction in pain scores across all surgical subtypes (Table 3, Figure 2).

Table 3. Comparison of postoperative patient satisfaction scores (SAT) between fentanyl and control groups

Time (hours)	Sep-Fentanyl	Sep-Control	p-value	FESS-Fentanyl	FESS-Control	p-value	Sep+FESS-Fentanyl	Sep+FESS-Control	p-value
1	6.13 ± 0.34	4.00 ± 0.00	<0.001	7.00 ± 0.00	5.25 ± 0.44	<0.001	6.75 ± 0.57	4.06 ± 0.25	<0.001
3	6.38 ± 0.49	4.04 ± 0.25	<0.001	7.19 ± 0.40	5.00 ± 0.00	<0.001	6.88 ± 0.49	4.75 ± 0.44	<0.001
6	7.00 ± 0.00	5.00 ± 0.00	<0.001	7.88 ± 0.34	5.94 ± 0.25	<0.001	7.38 ± 0.61	5.19 ± 0.40	<0.001
12	7.31 ± 0.47	5.88 ± 0.34	<0.001	8.25 ± 0.44	6.94 ± 0.25	<0.001	7.94 ± 0.25	6.13 ± 0.34	<0.001
24	8.06 ± 0.25	7.00 ± 0.51	<0.001	9.00 ± 0.00	7.94 ± 0.25	<0.001	8.25 ± 0.44	7.13 ± 0.34	<0.001

36	9.00 ± 0.00	8.13 ± 0.49	<0.001	9.00 ± 0.00	8.44 ± 0.50	<0.001	8.94 ± 0.25	8.38 ± 0.49	<0.001

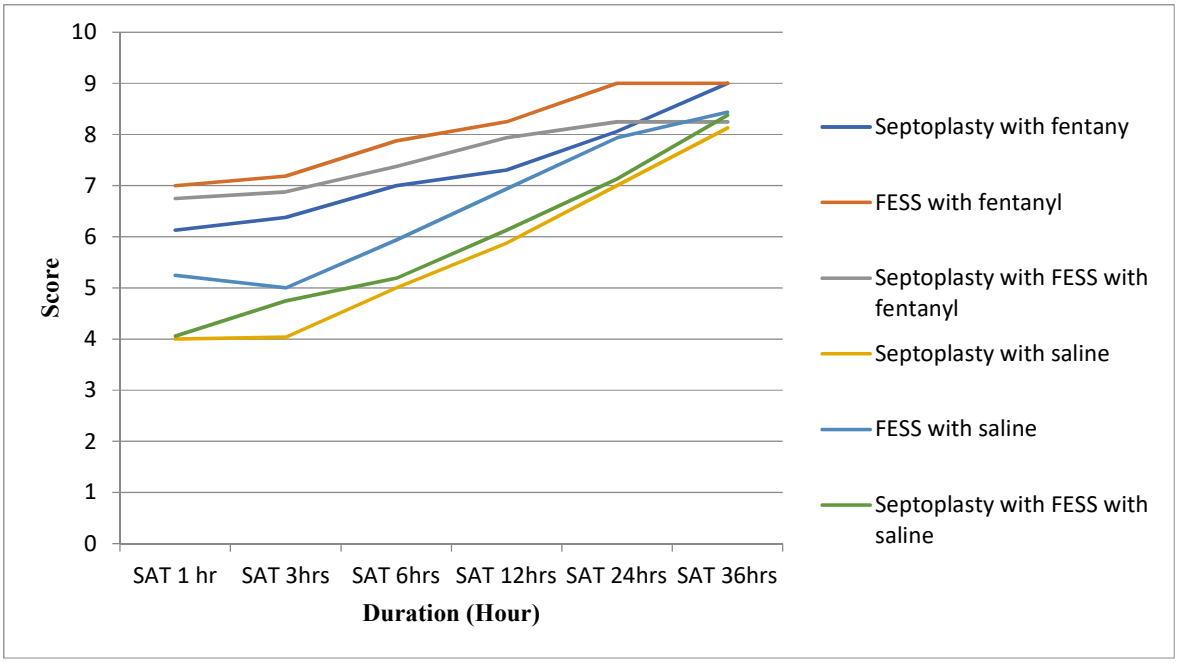

Fig. 2: The Patient Satisfactory Score between the fentanyl group and the saline group at different time intervals

Secondary Outcomes

Sedation (RSS)

A statistically significant but clinically mild increase in sedation was observed in the fentanyl group at the 3-hour assessment (median RSS 3 vs. 2 in the control group, p = 0.012). This effect was more evident in patients undergoing FESS and combined procedures.

Importantly, no patient in either group exhibited deep sedation (RSS > 4) at any time point, and sedation scores returned to baseline levels by 6 hours postoperatively (Table 4).

Table 4. Comparison of postoperative sedation scores (Ramsay Sedation Scale, RSS) between fentanyl and control groups

Time (hours)	Sep-Fentanyl	Sep-Control	p-value	FESS-Fentanyl	FESS-Control	p-value	Sep+FESS-Fentanyl	Sep+FESS-Control	p-value
1	3.00 ± 0.00	3.00 ± 0.00	NA	2.94 ± 0.25	3.00 ± 0.00	0.156	3.00 ± 0.00	3.00 ± 0.00	NA
3	2.19 ± 0.40	2.00 ± 0.00	0.100	2.38 ± 0.49	2.00 ± 0.00	<0.001	2.34 ± 0.48	2.00 ± 0.00	<0.001
6	2.00 ± 0.00	2.00 ± 0.00	NA	2.00 ± 0.00	2.00 ± 0.00	NA	2.00 ± 0.00	2.00 ± 0.00	NA
12	2.00 ± 0.00	2.00 ± 0.00	NA	2.00 ± 0.00	2.00 ± 0.00	NA	2.00 ± 0.00	2.00 ± 0.00	NA
24	2.00 ± 0.00	2.00 ± 0.00	NA	2.00 ± 0.00	2.00 ± 0.00	NA	2.00 ± 0.00	2.00 ± 0.00	NA
36	2.00 ± 0.00	2.00 ± 0.00	NA	2.00 ± 0.00	2.00 ± 0.00	NA	2.00 ± 0.00	2.00 ± 0.00	NA

Hemodynamic Parameters

There were no statistically significant or clinically meaningful differences between the two groups in systolic or diastolic blood pressure or pulse rate at any postoperative time point. Although isolated statistically significant differences were noted at a few time points, these were not clinically relevant and all values remained within physiologically acceptable limits.

Respiratory rate remained stable in both groups throughout the study period, with no clinically significant variation observed (Table 5A and 5B).

Table 5A. Comparison of postoperative blood pressure between fentanyl and control groups

Time (hours)	Sep-Fentanyl	Sep-Control	p-value	FESS-Fentanyl	FESS-Control	p-value	Sep+FESS-Fentanyl	Sep+FESS-Control	p-value
SBP 1	120.00 ± 5.93	121.56 ± 3.52	0.372	124.63 ± 3.40	126.88 ± 6.20	0.213	121.75 ± 4.49	122.38 ± 3.20	0.654
SBP 3	119.50 ± 5.77	121.38 ± 3.16	0.279	124.63 ± 3.91	124.88 ± 6.20	0.892	119.25 ± 4.55	124.38 ± 4.52	0.003
SBP 6	117.00 ± 5.22	119.13 ± 3.18	0.174	124.38 ± 3.52	126.88 ± 6.20	0.171	121.75 ± 4.49	123.50 ± 3.46	0.227
SBP 12	116.75 ± 4.89	115.13 ± 3.01	0.267	121.38 ± 3.24	121.00 ± 5.16	0.807	119.63 ± 4.21	121.13 ± 3.18	0.264
SBP 24	119.38 ± 4.30	119.88 ± 2.25	0.683	120.75 ± 3.34	121.38 ± 4.30	0.649	119.75 ± 3.86	118.88 ± 3.01	0.480
SBP 36	116.50 ± 3.97	117.63 ± 2.22	0.330	117.88 ± 3.69	120.38 ± 4.63	0.101	119.75 ± 4.44	118.88 ± 3.26	0.530
DBP 1	82.00 ± 4.20	81.38 ± 3.70	0.658	84.00 ± 4.84	84.88 ± 4.32	0.594	81.75 ± 2.18	82.75 ± 2.30	0.216
DBP 3	79.75 ± 3.57	79.25 ± 3.72	0.701	81.25 ± 3.92	80.75 ± 4.37	0.736	79.13 ± 2.19	80.50 ± 2.48	0.106
DBP 6	76.13 ± 3.22	75.25 ± 3.72	0.482	77.13 ± 4.00	72.00 ± 4.62	0.002	76.88 ± 2.06	77.63 ± 2.85	0.400
DBP 12	75.75 ± 3.34	74.50 ± 4.53	0.381	74.50 ± 3.90	74.38 ± 4.21	0.931	75.13 ± 2.31	75.63 ± 2.85	0.589
DBP 24	76.13 ± 3.61	75.38 ± 3.78	0.570	74.00 ± 3.72	74.38 ± 4.21	0.791	73.63 ± 2.75	73.75 ± 3.09	0.905
DBP 36	73.13 ± 3.01	74.75 ± 4.12	0.213	72.38 ± 3.74	72.50 ± 4.29	0.931	74.13 ± 2.36	72.88 ± 4.32	0.318

Table 5B. Comparison of postoperative pulse rate and respiratory rate between fentanyl and control groups

Time (hours)	Sep-Fentanyl	Sep-Control	p-value	FESS-Fentanyl	FESS-Control	p-value	Sep+FESS-Fentanyl	Sep+FESS-Control	p-value
PR 1	83.75 ± 2.72	84.13 ± 2.87	0.707	83.75 ± 2.18	83.38 ± 3.24	0.704	83.50 ± 2.48	83.25 ± 2.62	0.783
PR 3	81.50 ± 3.14	81.13 ± 2.42	0.708	80.00 ± 2.19	81.25 ± 3.72	0.255	77.38 ± 2.80	75.50 ± 2.37	0.050
PR 6	79.63 ± 3.36	80.38 ± 2.66	0.489	82.13 ± 2.36	80.50 ± 3.83	0.159	75.25 ± 2.19	76.50 ± 2.13	0.167
PR 12	77.75 ± 3.49	76.88 ± 2.31	0.410	74.88 ± 2.42	74.88 ± 3.26	1.000	71.13 ± 2.63	72.50 ± 2.48	0.138
PR 24	77.50 ± 3.39	76.69 ± 1.82	0.404	71.50 ± 2.97	73.00 ± 3.43	0.195	73.50 ± 2.78	73.38 ± 2.71	0.898
PR 36	74.63 ± 3.35	75.75 ± 1.88	0.366	73.50 ± 3.06	72.75 ± 2.72	0.469	70.88 ± 2.53	72.00 ± 2.63	0.227
RR 1	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA
RR 3	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA
RR 6	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA
RR 12	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA
RR 24	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA

RR 36	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA	16.00 ± 0.00	16.00 ± 0.00	NA

Adverse Events and Rescue Analgesia

The overall incidence of adverse events was low in both groups. Minor complaints such as headache (8.3% vs. 14.6%) and sore throat (5.2% vs. 11.5%) were less frequent in the fentanyl group. No episodes of respiratory depression, clinically significant nausea, vomiting, or pruritus were observed in the fentanyl group.

Notably, the requirement for rescue analgesia was significantly reduced in the fentanyl group, with only 22.9% of patients requiring tramadol compared to 67.7% in the control group ($p < 0.001$). In addition, the mean total tramadol consumption during the first 36 postoperative hours was significantly lower in the fentanyl group (12.5 ± 18.7 mg vs. 47.9 ± 32.1 mg, $p < 0.001$).

This represents a clinically meaningful reduction in postoperative opioid requirement, demonstrating a substantial opioid-sparing effect associated with the use of fentanyl-soaked nasal packing.

DISCUSSION

This prospective, randomized, double-blind controlled trial demonstrates that the application of fentanyl-soaked nasal packs (50 µg) provides superior postoperative analgesia compared to placebo following common nasal surgeries. The intervention resulted in statistically significant and clinically meaningful reductions in pain scores, accompanied by improved patient satisfaction and a marked reduction in the requirement for systemic rescue opioids, without evidence of clinically significant adverse effects.

The efficacy of intranasal fentanyl is supported by its favorable pharmacokinetic profile. The highly vascular nasal mucosa enables rapid drug absorption into the systemic circulation, bypassing hepatic first-pass metabolism and producing an onset of action comparable to intravenous administration [7,8,9]. In addition, the high lipophilicity of fentanyl facilitates local tissue penetration and interaction with peripheral µ-opioid receptors present on sensory nerve endings within the nasal mucosa and submucosa [20,21]. This combined local and systemic mechanism likely accounts for the sustained analgesic effect observed over 36 hours following a single low-dose application. Our findings are consistent with previous studies by Kim et al. [15] and others [16,18], while extending their applicability across a broader spectrum of nasal surgical procedures.

An important finding of the present study is the favorable safety profile of this intervention. Although a transient increase in sedation was observed at 3 hours postoperatively (median RSS 3, corresponding to "responsive to commands") [19], this was clinically mild, self-limiting, and not associated with respiratory compromise. Furthermore, no episodes of respiratory depression, nausea, or vomiting were observed, which contrasts with the known adverse effect profile of systemically administered opioids [6,23]. These findings suggest that localized delivery via nasal packing achieves effective analgesia while maintaining systemic drug concentrations below the threshold for significant opioid-related adverse effects.

With regard to hemodynamic parameters, although isolated statistically significant differences in systolic and diastolic blood pressure were observed at certain postoperative time points, these variations were transient, inconsistent across groups, and not associated with any clinical instability. Overall, heart rate, blood pressure, and respiratory rate remained within physiological limits throughout the observation period, supporting the hemodynamic safety of this technique.

A key clinical implication of this study is the significant reduction in rescue tramadol requirement (from 67.7% to 22.9% of patients), demonstrating a clear opioid-sparing effect. This reduction in overall opioid exposure is particularly relevant in the current context of efforts to minimize opioid-related adverse effects and dependency, and is consistent with the principles of multimodal and opioid-sparing analgesia in enhanced recovery protocols [5]. In addition, the higher patient satisfaction scores observed in the fentanyl group likely reflect a combination of improved pain control, greater comfort with nasal packing, and reduced need for additional systemic analgesics.

From a practical perspective, this technique is simple, cost-effective, and easily incorporated into routine surgical practice. It does not require additional equipment, specialized training, or active patient participation, making it a feasible and scalable intervention in otorhinolaryngological settings [10].

Limitations and Future Research

This study has certain limitations. First, postoperative pain assessment was limited to 36 hours, and pain following pack removal at 72 hours was not evaluated. Second, a fixed dose of 50 µg fentanyl was used; dose-ranging studies are required to determine the optimal balance between efficacy and safety. Third, the single-center design may limit the generalizability of the findings, and larger multicenter studies are needed for validation. Fourth, plasma fentanyl levels were not measured, precluding direct correlation between systemic concentrations, analgesic efficacy, and side effects. Finally, long-term outcomes such as effects on mucosal healing, adhesion formation, and chronic pain were not assessed. Future studies should address these

aspects, compare fentanyl nasal packing with other local analgesic agents (e.g., levobupivacaine) or alternative delivery methods, and evaluate cost-effectiveness.

CONCLUSION

The use of fentanyl-soaked nasal packs (50 µg) is an effective, safe, and well-tolerated strategy for postoperative pain management following septoplasty, functional endoscopic sinus surgery (FESS), and combined nasal procedures. This intervention provides superior analgesia and improved patient satisfaction compared to placebo, while significantly reducing the requirement for systemic rescue opioids, thereby demonstrating a clear opioid-sparing effect. Importantly, these benefits are achieved without clinically significant adverse effects. Given its simplicity, cost-effectiveness, and ease of integration into routine practice, this targeted, non-invasive approach may serve as a valuable adjunct to multimodal analgesic protocols in elective nasal surgery.

Consent and Ethical Approval

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee prior to commencement of the study. Written informed consent was obtained from all participants.

Conflict of Interest and Funding: Authors declare that they have no conflict of interest. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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