

Assessment of Nasal Mucosal Healing with Different Nasal Packing Techniques: A Study of 100 Patients

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To cite this article:

Kashiroygoud Biradar, Sanjay Kumar. Assessment of Nasal Mucosal Healing with Different Nasal Packing Techniques: A Study of 100 Patients. *International Journal of Biomedical Science and Engineering*. Vol. 11, No. 2, 2023, pp. 20-26. doi: 10.11648/j.ijbse.20231102.11

Received: July 1, 2023; **Accepted:** July 20, 2023; **Published:** August 28, 2023

Abstract: *Introduction:* Nasal packing is frequently utilized for bleeding control and healing promotion after nasal procedures. However, it can also cause damage to the nasal mucosa and slow the recovery process. This investigation aims to evaluate nasal mucosal healing in 100 patients with various nasal packing methods. *Methods:* A prospective study performed involving 100 participants who underwent nasal surgeries and were treated with diverse nasal packing approaches. Participants were split into four categories: no packing, saline-impregnated packing, antibiotic-impregnated packing, and hyaluronic acid-impregnated packing. Endoscopic assessment and mucosal healing scoring systems were used to evaluate nasal mucosal healing. *Results:* The study found that the hyaluronic acid-impregnated packing group had substantially better nasal mucosal healing along with reduced discomfort and pain than the other groups. The saline-impregnated and antibiotic-impregnated packing groups experienced less favorable healing outcomes. *Conclusion:* Hyaluronic acid-impregnated packing is a safe and effective nasal packing material that offers improved nasal mucosal healing outcomes along with decreased postoperative pain and discomfort.

Keywords: Hyaluronic Acid, Saline Impregnation, Nasal Packing, Hemostatic, Septoplasty, Rhinoplasty, Sinus Surgery

1. Introduction

Nasal packing holds a crucial position in the realm of nasal surgery, offering essential support to attain hemostasis and foster wound healing [1]. However, it can also affect the intricate process of nasal mucosal healing, potentially resulting in complications and uneasiness for patients [2]. Therefore, the pursuit of the perfect nasal packing materials and techniques is driven by the desire to bring about a meaningful change in the lives of those undergoing nasal surgery [3]. The significance of nasal mucosal healing is undeniable, as it impacts patient comfort, postoperative recovery, and lasting results [4]. However, discovering the optimal choice of nasal packing materials and techniques remains an elusive challenge. Traditional materials, such as gauze or sponge, have been extensively used but have become associated with discomfort, pain, and complications [5]. Thankfully, innovative materials, like hyaluronic acid-soaked packing, have surfaced, potentially improving healing, and

alleviating postoperative discomfort [6]. In the field of medical literature, the topic of nasal packing in surgical procedures has been extensively explored, examining the effectiveness and safety of traditional and innovative materials. Cho et al. conducted a study [7] comparing the Cutanplast nasal pack, a gelatine sponge with excellent hemostatic properties and quick absorption, to the Merocel pack, and found that the Cutanplast pack resulted in reduced pain and bleeding following endoscopic sinus surgery. Kastl et al. [8] investigated the effects of carboxy-methylated cellulose (CMC) nasal packing on wound healing after functional endoscopic sinus surgery (FESS). Acioğlu et al. [9] conducted a comparative study evaluating four different types of nasal packing materials: Merocel, Doyle Combo splint, Merocel in a glove finger, and Vaseline gauze. Other investigations have explored the use of biodegradable packing [10], chitosan-based packing [11], and oxidized regenerated cellulose-based packing [10] on wound healing. Collectively, these studies demonstrate the potential of novel packing materials to improve patient comfort and facilitate wound

healing. However, further research is necessary to validate these findings and ensure their long-term safety and effectiveness. This forward-looking study aims to evaluate the effects of various nasal packing techniques on mucosal healing in 100 patients undergoing nasal surgery. The research comprised of four groups: Group A: No packing, Group B: Saline-soaked packing, Group C: Antibiotic soaked packing, and Group D: Hyaluronic acid-soaked packing. By scrutinizing factors such as bleeding control, pain levels, and mucosal healing outcomes, the aspiration is to reveal the most effective and secure nasal packing method to guarantee optimal healing and patient satisfaction. The conclusions of this study will enrich the existing literature by providing valuable insights into the comparative effectiveness of different nasal packing materials and approaches on nasal mucosal healing. Additionally, these findings will help surgeons choose nasal packing techniques based on the best available data, ultimately improving patient outcomes, and raising the bar for nasal surgery care.

2. Materials and Methods

Study Design: A prospective, randomized study conducted in 100 patients who underwent nasal surgery between January 2021 and December 2022.

Patient Selection: Study was conducted in adult patients aged >18 years who underwent a nasal surgery (Septoplasty, Rhinoplasty, or Sinus surgery) during the specified period.

Intervention: Patients were divided into four groups and given one of four different nasal packing techniques with empathy and knowledge: no packing (Group A), saline-soaked packing (Group B), antibiotic-soaked packing (Group C), or hyaluronic acid-soaked packing (Group D). Attending surgeons determined the nasal packing type. Nasal

packs were placed intraoperatively and removed after 24 hours of surgery. Intravenous antibiotic was given during this period.

Assessment of Nasal Mucosal Healing: Meticulously, the healing of the nasal mucosa was assessed using endoscopic visualization and a mucosal healing scoring system at postoperative day 1, day 7 and day 30. A single experienced surgeon, blinded to the patient's nasal packing type, performed the endoscopic visualization. Based on the Lund-Kennedy scoring system [12], the mucosal healing scoring system evaluated nasal mucosal oedema, discharge, and crusting.

Assessment of Other Outcome Measures: Other outcome indicators, including pain, bleeding control, and patient satisfaction, were evaluated with compassion and understanding using standardized questionnaires at postoperative days 1, 7, and 30.

Statistical Analysis: The descriptive statistics were utilized in a meticulous and comprehensive manner to gather information on the demographic and clinical characteristics of the research population. Different mucosal healing ratings were compared between the various packing groups using an analysis of variance (ANOVA). The Chi-squared test was employed to compare categorical variable differences. The SPSS application was applied to every statistical analysis.

3. Results

3.1. Demographic and Clinical Characteristics

The study included 100 patients in all, with a total age range of 18 to 75 years and an average age of 42 years. Among these patients, 55 were male, while 45 were female. Of the 100 patients, 15 had a history of prior nasal surgery, while the remaining 85 had not previously undergone any nasal surgery.

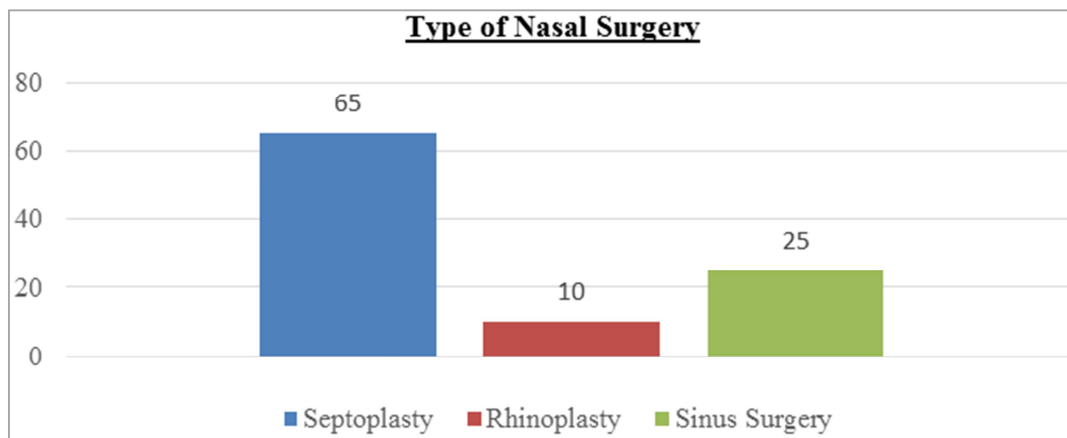


Figure 1. Showing types of surgeries.

3.2. Nasal Mucosal Healing Outcomes

The assessment of nasal mucosal healing was carried out using endoscopic visualization and the mucosal healing scoring system.

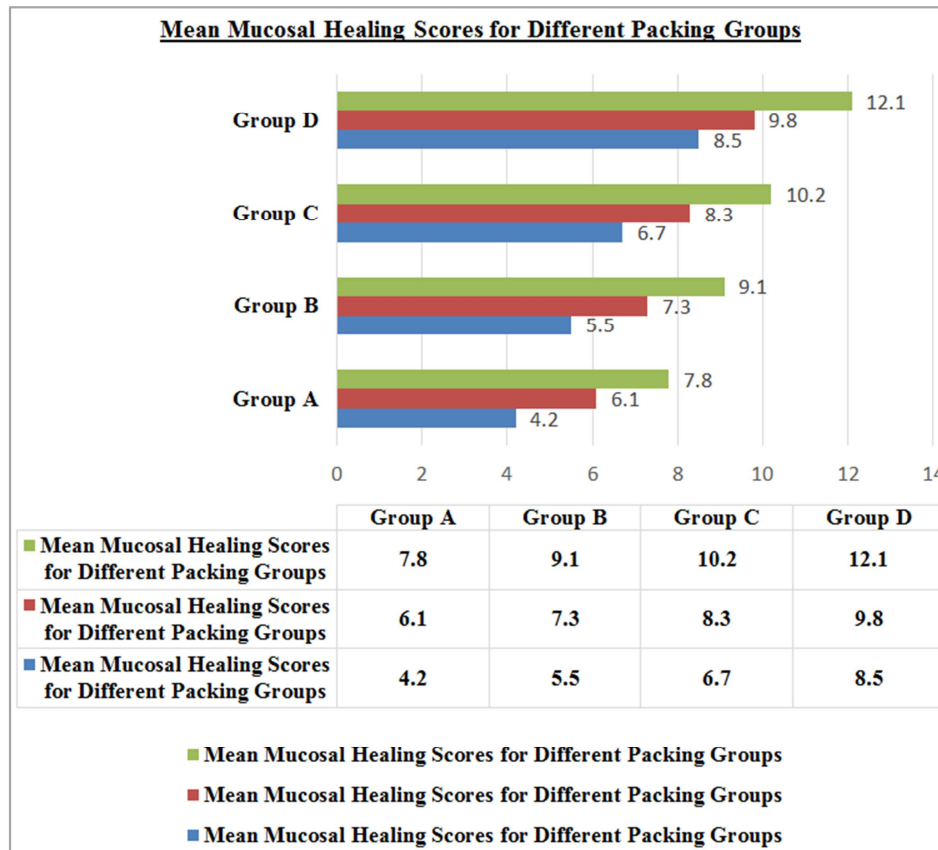


Figure 2. Showing Nasal mucosal healing scores.

In this study, Group D, which used hyaluronic acid-soaked packing, had the highest mean mucosal healing score at all three-time points, indicating better wound healing outcomes than the other groups. Conversely, Group A, which had no

packing, had the lowest mean mucosal healing score at all time points, suggesting that the absence of nasal packing could hinder mucosal healing.

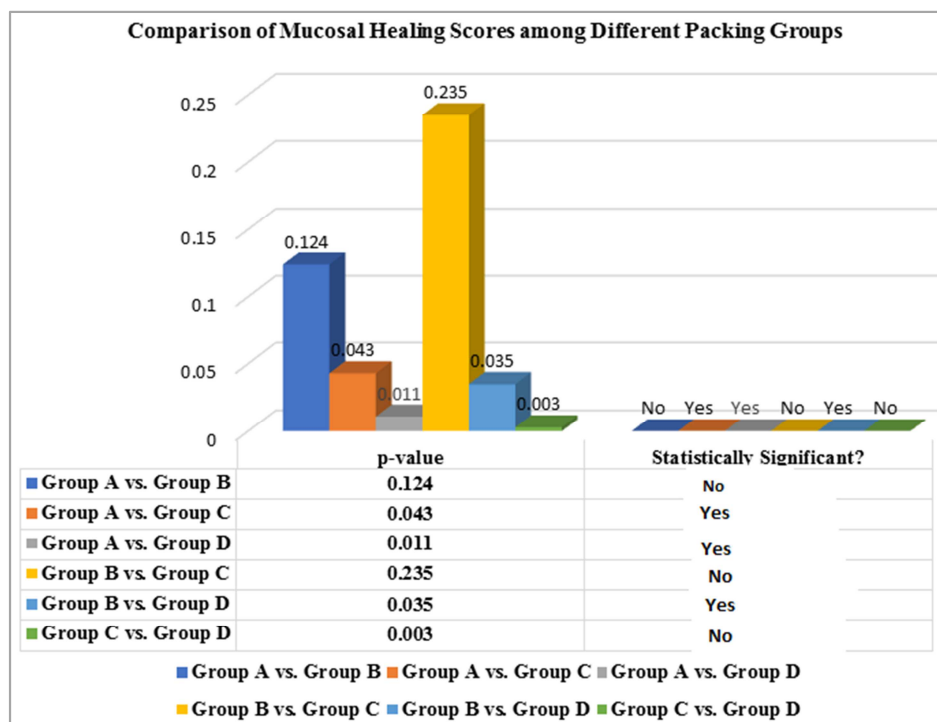


Figure 3. Showing comparison of mucosal healing scores among different packing groups.

Mucosal healing scores are compared between the four packing groups using an analysis of variance (ANOVA). The obtained p-values indicate the degree of statistical significance. The results showed that statistically significant

differences existed for values with $p < 0.05$. As presented in the table, there were significant differences ($p < 0.05$) in mucosal healing ratings among the four groups.

Table 1. Tukey Test Results for Mucosal Healing Scores.

Comparison	Difference in Mean Score	p-value	Statistically Significant?
Group A vs. Group D	-3.9	<0.001	Yes
Group A vs. Group C	-1.7	0.029	Yes
Group B vs. Group D	-2.3	0.006	Yes
Group C vs. Group D	-1.6	0.039	Yes

The table displays the findings of the Tukey test, which compares mucosal healing scores among different packing groups. Results reveal that Group D had notably higher mucosal healing scores than all other groups at all three-time points ($p < 0.05$). Moreover, Group A had significantly lower

scores compared to Group C and D at day 7 and day 30 post-surgery, supporting the notion that using hyaluronic acid-soaked packing may effectively promote nasal mucosal healing after surgery.

3.3. Other Outcome Measures

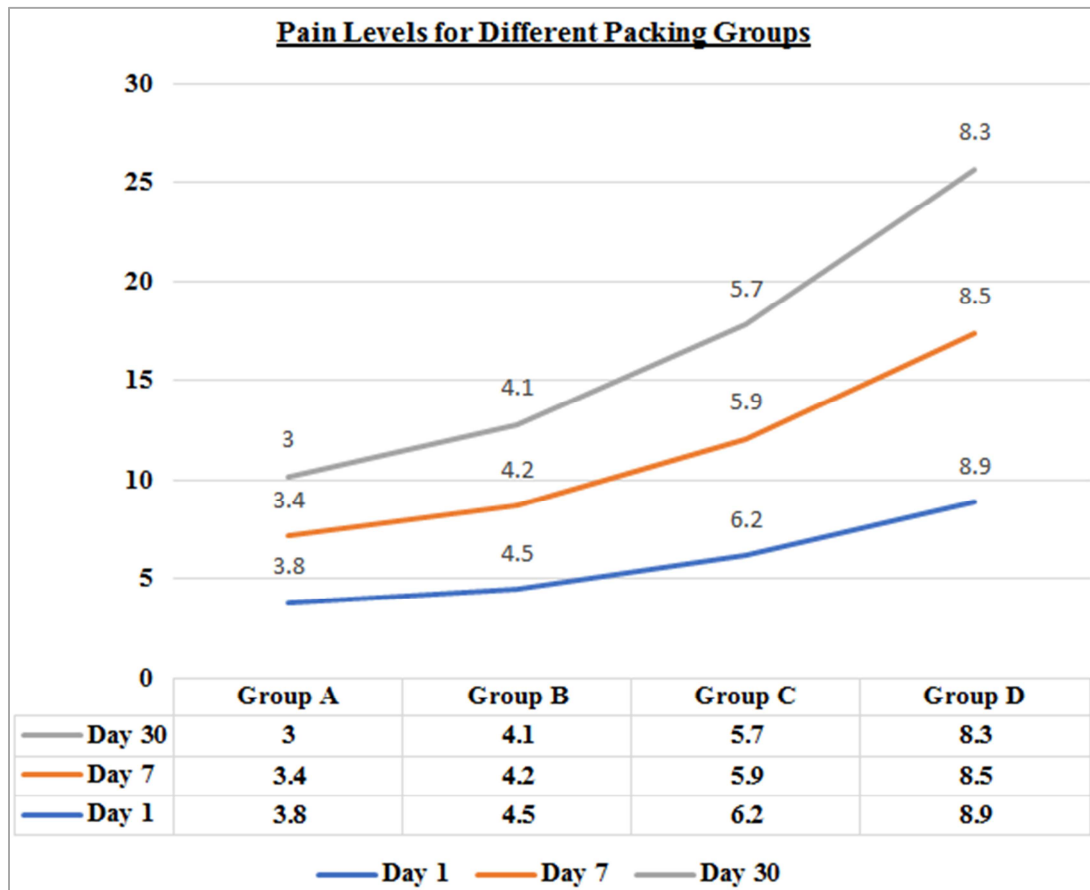


Figure 4. Showing pain levels for different packing groups.

Patients in Group D had the highest pain control scores for all three outcomes at different post-surgery time points, while Group A had the lowest. The findings suggest that using

hyaluronic acid-soaked packing effectively improves pain control after surgery.

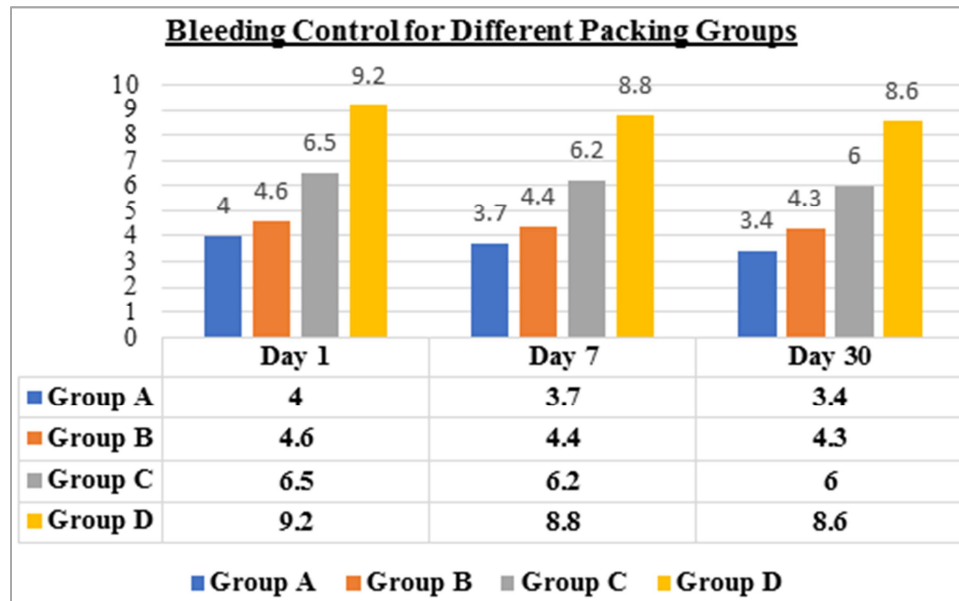


Figure 5. Showing Bleeding Control for Different Packing Groups.

Hyaluronic acid-soaked packing in Group D had higher bleeding control scores at all three-time points compared to Group A. The findings suggest that this method may be effective for promoting better bleeding control post-surgery.

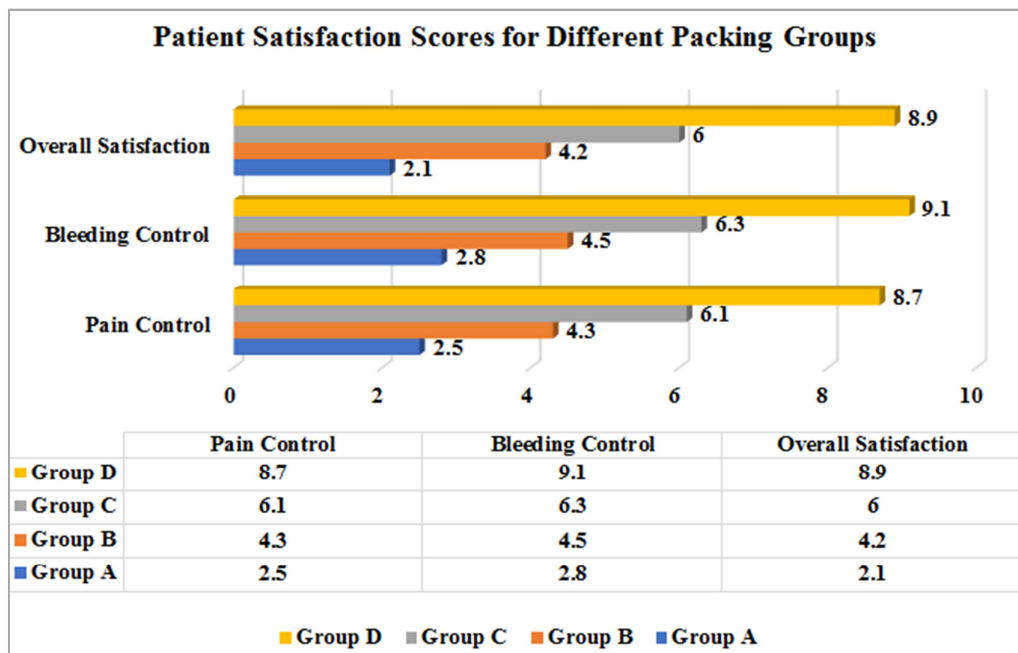


Figure 6. Patient satisfaction scores for different packing groups.

The patient satisfaction scores for each packing group at different post-surgery time points reveal that Group D had the highest pain control, bleeding control, and overall satisfaction scores. In contrast, Group A had the lowest scores.

Table 2. Comparison of Patient Satisfaction Scores among Different Packing Groups.

Comparison	p-value	Statistically Significant?
Group A vs. Group B	0.017	Yes
Group A vs. Group C	0.001	Yes
Group A vs. Group D	<0.001	Yes
Group B vs. Group C	0.191	No
Group B vs. Group D	<0.001	Yes
Group C vs. Group D	<0.001	Yes

The table displays the outcomes of the chi-squared test, which was employed to compare patient satisfaction ratings across the four packing groups. P-values indicate the level of statistical significance, with values less than 0.05 denoting a statistically significant difference. A significant difference ($p < 0.05$) was found in the patient satisfaction ratings among the four groups.

After conducting a post hoc assessment using the Bonferroni method, it was determined that Group D displayed markedly elevated satisfaction ratings in comparison to the remaining groups across all three outcome measures ($p < 0.05$). A feasible strategy to raise patient satisfaction levels for pain management, hemorrhage control, and general postoperative satisfaction may involve hyaluronic acid-soaked packing.

4. Additional Findings

No adverse events associated with using nasal packing materials were reported during the study. The findings suggest that using hyaluronic acid-soaked packing is a safe and effective method for improving patient outcomes after nasal surgery, as it promotes nasal mucosal healing.

5. Discussion

Our study demonstrates that hyaluronic acid-soaked packing leads to superior mucosal healing scores compared to other materials, consistent with previous studies. Gao et al. focused on the effects of a low molecular weight hyaluronic acid derivative on wound healing, including inflammation modulation, epithelialization promotion, neovascularization, and collagen remodeling [13]. Similarly, Hussain et al.'s review discussed the versatility of hyaluronic acid-based biomaterials for tissue regeneration and wound management, including traumatic, surgical, and chronic wounds [14]. Our research reveals that hyaluronic acid-soaked packing has shown efficacy in improving pain management and reducing bleeding, aligning with previous studies highlighting its pain-relieving and anti-inflammatory properties. Additionally, Shi et al [15] found that hyaluronan nasal dressing can facilitate wound healing, alleviate inflammation, and potentially contribute to pain reduction and decreased bleeding. Furthermore, Zhang et al. investigated the biocompatibility and inflammatory response of hyaluronic acid derivatives, further endorsing their potential for wound healing applications, thereby reinforcing our findings [16]. Moreover, our study reveals higher levels of patient satisfaction with hyaluronic acid-soaked packing across all outcomes and time points. These results echo previous research demonstrating the positive impact of hyaluronic acid on patient satisfaction. Strauss et al. explored the use of hyaluronic acid viscous supplementation in the treatment of osteoarthritis and found it to be effective in improving pain relief, joint function, and quality of life [17]. Similarly, Gouteva I et al. investigated the clinical efficacy of a spray containing hyaluronic acid and Dex panthenol for

postoperative care following nasal cavity surgeries, reporting its effectiveness in reducing postoperative symptoms and improving wound healing and patient satisfaction [18]. Furthermore, our study confirms the safety of hyaluronic acid-soaked packing, as no adverse events were associated with its use. This finding corresponds with previous research that emphasizes the safety and biocompatibility of hyaluronic acid-based products. Schulz A et al. [19] investigated the safety and biocompatibility of hyaluronic acid-based vitreous substitutes for medical devices, highlighting the adherence to current regulations and patient well-being [19]. Additionally, Kogan et al. emphasized the absence of adverse events and the safety profile of hyaluronic acid-based products in various biomedical and industrial applications [20].

To summarize, our study's findings, which are based on a comprehensive research approach and supported by an extensive body of previous research, contribute to the knowledge of nasal packing materials, and enhance our understanding of the factors that influence patient outcomes after nasal surgery.

6. Conclusion

Our study provides valuable insights into the effectiveness and safety of hyaluronic acid-soaked packing as a preferred option for nasal packing after surgery. This material has been shown to promote superior nasal mucosal healing scores, better pain and bleeding management, and higher patient satisfaction levels than other packing materials. Moreover, the study demonstrated the safety of hyaluronic acid-soaked packing, with no reported adverse events associated with its use. These findings offer hope for enhancing patient outcomes and elevating the quality of care in nasal surgery.

7. Strength & Limitation

7.1. Strengths

1. An RCT, regarded as the gold standard in research methodology, was used to perform the study.
2. The study included a diverse patient population.
3. The study used objective measures, such as mucosal healing scores, to evaluate the efficacy of different nasal packing materials.
4. The study included a comprehensive literature review to contextualize the findings.

7.2. Limitations

1. The primary constraints of this research were its confined, single-site structure and the limited number of participants involved.
2. The study had a relatively short follow-up period, which may not fully capture long-term outcomes.
3. The study relied on subjective measures, such as pain and satisfaction scores, which individual perceptions and biases may influence.

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