

Intranasal adhesions following septoplasty and septoturbinioplasty – a narrative review

Zrosty wewnętrzznosowe po septoplastyce i septokonchoplastyce – przegląd narracyjny

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Abstract:

Background. Intranasal adhesions (synechia) are among the most common complications following septoplasty and septoconchoplasty. Although often considered minor, they may impair nasal airflow, reduce patient satisfaction, and contribute to persistent nasal obstruction requiring additional treatment. **Objective.** To review current evidence regarding the incidence, risk factors, prevention, and management of intranasal adhesions following septoplasty and septoconchoplasty. **Materials and Methods:** A narrative review was conducted using the PubMed database. Nine studies directly addressing postoperative adhesions after septoplasty or septoconchoplasty were identified. Following manual reference screening and inclusion of relevant supporting publications, a total of 21 articles were reviewed. Original studies, comparative studies, randomized trials, cohort studies, and relevant reviews published in English were included. **Results.** Reported adhesion rates varied substantially across studies, ranging from approximately 3,1% to 26,75% in studies specifically evaluating septal surgery. Higher rates, 36,2%, have been reported, particularly following procedures involving the inferior turbinates. The main factors associated with adhesion formation were mucosal injury, contact between opposing raw surfaces, and postoperative management. Evidence regarding routine use of septal splints remains conflicting, although several studies demonstrated reduced adhesion rates, particularly in high-risk patients. Transseptal suturing appears to be an effective alternative to nasal packing, while traditional gauze packing may increase adhesion risk. Endoscopic techniques may reduce mucosal trauma and postoperative complications. Limited evidence suggests that topical mitomycin C may be beneficial in selected cases. **Conclusions.** Intranasal adhesions remain a clinically relevant complication of septoplasty and septoconchoplasty. Preservation of mucosal integrity, minimization of tissue trauma, and appropriate postoperative care are essential for reducing their occurrence.

Abstract (in Polish):

Wstęp. Zrosty wewnętrzznosowe (synechie) należą do najczęstszych powikłań po septoplastyce i septokonchoplastyce; mimo, iż nie są uznawane za powikłania o ciężkim charakterze, mogą prowadzić do pogorszenia drożności nosa, zmniejszenia satysfakcji pacjenta oraz utrzymywania się niedrożności nosa wymagającej dodatkowego leczenia. **Cel.** Przegląd aktualnego piśmiennictwa dotyczącego częstości występowania, czynników ryzyka, profilaktyki oraz leczenia zrostów po septoplastyce i septokonchoplastyce. **Materiały i metody.** Narracyjny przegląd piśmiennictwa z wykorzystaniem bazy PubMed. Zidentyfikowano dziewięć badań bezpośrednio dotyczących zrostów pooperacyjnych po septoplastyce lub septokonchoplastyce. Po przeprowadzeniu ręcznej analizy piśmiennictwa cytowanego w zakwalifikowanych pracach oraz włączeniu istotnych publikacji uzupełniających ostatecznie analizie poddano 21 artykułów. Uwzględniono prace oryginalne, badania porównawcze, badania randomizowane, kohortowe oraz istotne prace przeglądowe opublikowane w j. angielskim. **Wyniki.** raportowana częstość występowania zrostów wynosiła od 3,1% do 26,75%. Wartości wyższe, 36,2%, były opisywane zwłaszcza w kontekście chirurgii małżowin nosowych. Do głównych czynników związanych z powstawaniem zrostów należały: uszkodzenie błony śluzowej, kontakt przeciwległych powierzchni pozbawionych nabłonka oraz sposób postępowania pooperacyjnego. Dane dotyczące rutynowego stosowania separatorów wewnętrzznosowych pozostają niejednoznaczne, jednak w kilku badaniach wykazano zmniejszenie częstości występowania zrostów, szczególnie u pacjentów z grup podwyższonego ryzyka. Alternatywą dla tamponady nosa może być szew przezprzegrodowy; należy wskazać, iż zastosowanie gazy setonowej zwiększa ryzyko zrostów. Techniki endoskopowe mogą ograniczać uszkodzenia błony śluzowej, a w rezultacie obniżyć ryzyko komplikacji. Zastosowanie mitomycyny C, może być opcją do rozważenia w niektórych przypadkach. **Wnioski.** Zrosty pozostają istotnym powikłaniem septo- bądź septokonchoplastyki. Podstawowe znaczenie w profilaktyce ich wystąpienia mają zabezpieczenie integralności błony śluzowej, minimalizowanie uszkodzeń nabłonka i odpowiednia pielęgnacja ran w okresie pooperacyjnym.

1. Introduction

Nasal septal deviation is common, although only a proportion of affected individuals develop clinically relevant nasal obstruction requiring surgical correction. Septoplasty is therefore one of the most frequently performed procedures in otorhinolaryngology. Inferior turbinate hypertrophy often coexists with septal deviation and may be treated during the same operation.

Intranasal adhesions, also termed synechiae, are fibrous connections between opposing mucosal surfaces. Following septoplasty, they most commonly develop between the nasal septum and the inferior turbinate. Adhesion formation is promoted when two injured mucosal surfaces remain in contact during healing, particularly in the presence of blood clots, crusting, excessive local trauma, or inadequate postoperative care. Although synechiae are sometimes regarded as a minor complication, they may compromise nasal airflow, reduce patient satisfaction, and contribute to persistent or recurrent obstruction requiring additional treatment.

Reported adhesion rates vary substantially among studies because of differences in surgical technique, the extent of concomitant turbinate surgery, postoperative packing and splinting protocols, follow-up duration, and the definition and method of detecting synechiae. The aim of this narrative review was to summarize the available evidence on the incidence, clinical relevance, risk factors, prevention, and management of intranasal adhesions following septoplasty and septoturbinateplasty.

2. Materials and Methods

This study was conducted as a narrative review of the literature concerning intranasal adhesions after septoplasty and septoturbinateplasty. The search was conducted on 20 May 2026. PubMed was searched using the following strategy: ("nasal adhesions" OR "nasal synechiae" OR "intranasal adhesions" OR "intranasal synechiae") AND (septoplasty OR septoturbinateplasty OR septoturbinateplasty).

English-language original studies, comparative studies, randomized trials, cohort studies, and relevant reviews reporting the incidence, risk factors, prevention, or treatment of postoperative intranasal adhesions were considered. Additional publications were identified by screening the reference lists of eligible articles. Studies limited exclusively to endoscopic sinus surgery, dacryocystorhinostomy, or skull-base surgery were excluded unless their findings directly informed a preventive method also evaluated in septal surgery. Finally, nine articles were included in the analysis. In addition, relevant publications identified through manual reference screening were incorporated. In total, 20 articles were included in the preparation of this review.

Use of Artificial Intelligence

The authors used ChatGPT (OpenAI) to assist with manuscript preparation, including language editing, improvement of academic style, organization of the manuscript structure, summarization of literature findings, and drafting of selected text passages. All cited literature was reviewed by the authors, and all scientific interpretations, conclusions, and final manuscript content were critically evaluated, revised, and approved by the authors. The authors take full responsibility for the accuracy and integrity of the work.

3. Results

3.1. Incidence and clinical relevance

The reported frequency of intranasal adhesions after septal surgery varied markedly across the included studies. Eşki and Yılmaz prospectively evaluated 49 patients undergoing pack-free septoplasty with transseptal sutur-

ing and observed synechiae in three patients (6.1%) [1]. Ngamdu et al. reported adhesions in two of 14 patients (14.3%) after endoscopic septoplasty. However, 92.9% of the patients also underwent endoscopic sinus surgery, limiting attribution of the complication to septoplasty alone [2].

In a retrospective cohort of 243 patients undergoing septoplasty or septoturbinateplasty, Stępiński and Banasze-wski identified intranasal synechiae in 65 patients, corresponding to an overall rate of 26.75% [3]. By contrast, Mahmood et al. reported low rates in both groups of their quasi-experimental study: 3.1% among patients treated with splints and 3.8% among patients managed without splints ($p = 0.734$) [4].

Higher adhesion rates have been reported in the broader rhinosurgical literature. Rates of up to approximately 36.2% have been described following procedures involving the inferior turbinates; therefore, these values should not be interpreted as the incidence of synechiae specifically following septoplasty or septoturbinateplasty. This distinction is particularly important when comparing studies involving different surgical procedures and patient populations [21].

The clinical importance of synechiae is not fully captured by incidence studies alone. Derin et al. evaluated 50 patients undergoing revision surgery because of persistent or recurrent nasal obstruction after primary septoplasty and identified synechiae in 20% of this selected revision cohort [5]. This value should not be interpreted as the incidence of adhesions among all patients undergoing primary septoplasty; rather, it indicates that synechiae are a relevant anatomical cause of postoperative failure.

Table 1. Selected studies reporting intranasal adhesions after septal surgery.

Study	Design	Patients	Procedure/context	Adhesion findings
Eşki and Yılmaz, 2015 [1]	Prospective study	49	Pack-free septoplasty with transseptal suturing	3/49 (6.1%)
Ngamdu et al., 2023 [2]	Retrospective study	14	Endoscopic septoplasty; 92.9% with concomitant ESS	2/14 (14.3%)
Stępiński and Banasze-wski, 2025 [3]	Retrospective cohort	243	Septoplasty or septo-turbinateplasty	65/243 (26.75%)
Mahmood et al., 2016 [4]	Quasi-experimental study	260	Septoplasty; splints vs no splints	3.1% vs 3.8%; $p = 0.734$
Derin et al., 2016 [5]	Revision cohort	50	Revision for per-sistent/recurrent obstruction	Synechiae in 20% of revision patients
Malki et al., 1999 [10]	Randomized compara-tive study	110	Routine nasal surgery; splints vs no splints	No statistically signi-ficant reduction with splints; greater po-stopoperative morbidity

3.2. Risk factors

The formation of postoperative synechiae is closely related to mucosal injury and contact between opposing raw surfaces. This mechanism is particularly relevant when septoplasty is combined with lateral nasal wall surgery or when mucoperichondrial flap tears occur. In the study by Sayeed et al., only patients who developed a mucosal flap tear during endoscopic septoplasty and spurectomy were included, illustrating a deliberately high-risk population [6].

Stępiński and Banaszewski identified several modifiable perioperative factors. The absence of septal splints was associated with a markedly higher rate of synechiae (46.9% without splints vs 13.1% with splints; $P < 0.001$). Traditional seton gauze packing was also associated with an increased risk, and the combination of gauze packing and the absence of splints produced the highest observed rate of adhesion formation. By contrast, concomitant turbinoplasty was not significantly associated with synechiae (26.0% vs 27.7%; $p = 0.817$) [3].

The surgical approach may also affect adhesion formation. A review of prospective randomized studies found that conventional septoplasty using classical approaches, including the Cottle or Killian technique, was associated with a higher incidence of adhesions than endoscopic septoplasty [7]. The likely explanation is improved visualization and more targeted dissection during endoscopic surgery, although differences in case selection and operative extent may also contribute.

3.3. Prevention

3.3.1. Septal splints and separators

Evidence regarding routine septal splinting is heterogeneous. Campbell et al. evaluated intranasal splints in patients undergoing various nasal procedures and reported fewer adhesions on splinted sides, with the greatest apparent benefit when surgery involved both the septum and the lateral nasal wall [8]. This finding supports the concept that splints may be most useful when two opposing mucosal surfaces are simultaneously injured.

Other studies did not demonstrate a clear benefit. Cook et al. prospectively evaluated 100 adults undergoing septal surgery, with or without turbinoplasty, and found that splints significantly increased postoperative discomfort without providing a demonstrable clinical advantage [9]. Malki et al. similarly found no statistically significant reduction in adhesions and reported greater pain and discomfort among splinted patients [10]. Mahmood et al. observed adhesions in 3.1% of splinted patients and 3.8% of non-splinted patients ($p = 0.734$) [4].

Conversely, the cohort reported by Stępiński and Banaszewski showed a strong protective association with splint use (13.1% vs 46.9%; $P < 0.001$) [3]. Differences in operative extent, splint material and thickness, duration of placement, packing type, postoperative care, and baseline risk may explain these conflicting findings. Reviews have suggested that conventional thick splints may increase morbidity, whereas thin Silastic splints may provide a more favorable balance between tissue separation and patient comfort [11,12,13].

3.3.2. Transseptal suturing

Transseptal or quilting sutures have been proposed as an alternative to routine nasal packing. In the prospective series by Eşki and Yılmaz, pack-free septoplasty with transseptal suturing resulted in a 6.1% synechiae rate [1]. Naik reported a statistically significant reduction in adhesions with transseptal splint suturing compared with antibiotic-impregnated ribbon-gauze packing in a study of 200 patients [14].

However, a retrospective analysis of 697 septoplasty procedures found no statistically significant differences between transseptal suturing and packing in bleeding, septal hematoma, septal perforation, or intranasal adhe-

sions [15]. Suturing generally avoids the pressure and removal-related trauma of non-absorbable packing, but it may prolong operative time [16].

3.3.3. Nasal packing and packing materials

The influence of nasal packing appears to depend more on the material and the degree of mucosal trauma than on packing alone. In patients undergoing modified Cottle septoplasty, Özbal Koç et al. found no statistically significant difference in early adhesion formation among patients managed without packing, with Telfa, or with Merocel during the first two postoperative weeks [17]. The short follow-up period may, however, have failed to detect some later adhesions.

Dutta et al. described a modified technique combining conventional gauze with an aluminium-foil septal splint. This method was associated with less mucosal injury and fewer adhesions than conventional gauze or Merocel, while maintaining satisfactory hemostasis [18]. The increased risk observed with seton gauze in the cohort by Stępiński and Banaszewski further suggests that traumatic packing materials may promote adhesion formation [3].

3.3.4. Postoperative nasal irrigation

Postoperative irrigation facilitates the removal of blood clots and crusts and may support mucosal healing and mucociliary recovery. Kurtaran et al. compared tap water, buffered isotonic saline, buffered isotonic saline with xylitol, and 2.3% hypertonic seawater after septoplasty combined with radiofrequency turbionoplasty. Hypertonic seawater was the most effective solution for reducing dryness, edema, obstruction, postoperative deposits, and adhesions [19]. Because all patients underwent a combined procedure, the findings may not be fully generalizable to isolated septoplasty.

3.3.5. Surgical approach

Endoscopic septoplasty may reduce postoperative adhesions by improving visualization of posterior and inferior septal regions, allowing more precise dissection, and limiting unintended mucosal injury. Comparative literature reviewed by Champagne et al. favored the endoscopic approach with respect to overall intraoperative and postoperative complications, including adhesions [7]. Nevertheless, differences in surgeon experience, anatomical complexity, and the extent of concomitant procedures should be considered when interpreting this association.

3.3.6. Mitomycin C

Topical mitomycin C has been evaluated in patients at increased risk of adhesion formation. Sayeed et al. included 80 patients who developed mucoperichondrial flap tears during endoscopic septoplasty and spurectomy. Mitomycin C at a concentration of 0.4 mg/mL was applied to the injured area for five minutes in 40 patients, while saline was used in 40 controls. At one month, adhesions occurred in 17.5% of the mitomycin C group and 45% of the control group ($p = 0.008$) [6].

Although these findings are promising, they derive from a single high-risk cohort with short follow-up. The evidence is therefore insufficient to recommend routine mitomycin C use after septoplasty. Its application should remain selective and requires further assessment of efficacy, safety, dose, exposure time, and long-term mucosal effects.

3.4. Management of established adhesions

Evidence specifically comparing methods of treating established adhesions after septoplasty is limited. In the series by Ngamdu et al., both postoperative adhesions were divided under local anaesthesia, and neither patient required formal revision surgery [2]. This suggests that early, limited synechiae may be managed successfully with office-based adhesiolysis in selected patients.

Broader, mature, or recurrent adhesions may require operative adhesiolysis followed by temporary separation of the opposing mucosal surfaces and careful postoperative debridement or irrigation. However, robust comparative data on recurrence rates, the optimal duration of postoperative separation, and the role of adjunctive agents are lacking.

Table 2. Selected modifiable factors and preventive interventions.

Study	Factor/intervention	Comparison	Result	Interpretation
Stępiński and Banaszewski [3]	Septal splints	Splints vs no splints	13.1% vs 46.9%; ($p < 0.001$)	Protective association
Stępiński and Banaszewski [3]	Concomitant turbino-plasty	Yes vs no	26.0% vs 27.7%; ($p = 0.817$)	No significant association
Stępiński and Banaszewski [3]	Seton gauze	Traditional vs modern dressing strategies	Higher risk; ($p < 0.001$)	Potentially modifiable risk factor
Mahmood et al. [4]	Septal splints	Splints vs no splints	3.1% vs 3.8%; ($p = 0.734$)	No significant benefit
Sayeed et al. [6]	Topical mitomycin C	Mitomycin C vs saline	17.5% vs 45%; ($p = 0.008$)	Promising in a selected high-risk cohort
Cook et al. [9]	Septal splints	Splints vs no splints	No demonstrable benefit; greater discomfort	Selective rather than routine use
Malki et al. [10]	Septal splints	Splints vs no splints	No significant difference; more pain/discomfort	Routine use not supported

4. Discussion

The available literature confirms that intranasal synechiae are clinically relevant after septoplasty, but the reported incidence is highly variable. This heterogeneity reflects differences in study populations, operative techniques, concomitant procedures, definitions of adhesion, follow-up duration, and postoperative management. Small studies and cohorts enriched for high-risk patients should therefore not be directly compared with unselected septoplasty populations.

The 26.75% adhesion rate reported by Stępiński and Banaszewski was higher than the 14.3% rate reported by Ngamdu et al. and the 6.1% rate reported by Eşki and Yılmaz. However, these differences do not necessarily indicate differences in surgical quality. The Ngamdu study included only 14 patients and was confounded by concomitant endoscopic sinus surgery, whereas the Eşki study evaluated pack-free septoplasty with transseptal suturing. The larger Stępiński cohort included both septoplasty and septoturbinooplasty and was designed specifically to identify perioperative risk factors [1,2,3].

The 20% prevalence of synechiae described by Derin et al. has a different denominator and should be interpreted separately. It represents the proportion of patients with adhesions among those already selected for revision because of persistent or recurrent obstruction, not the incidence among all primary septoplasty procedures.

Nevertheless, this finding demonstrates that synechiae can have a meaningful effect on long-term functional outcomes and may contribute to surgical failure [5].

The most plausible pathophysiological mechanism is contact between opposing injured mucosal surfaces during the proliferative phase of wound healing. Accordingly, prevention should prioritize atraumatic elevation and preservation of mucoperichondrial flaps, avoidance of simultaneous raw surfaces on the septum and turbinate, removal of clots and crusts, and maintenance of separation when bilateral mucosal injury cannot be avoided. The high adhesion rate in the saline control group of the mitomycin C study is consistent with this mechanism because all included patients had flap tears [6].

The evidence for septal splints is conflicting. Older and contemporary comparative studies failed to show a significant benefit from routine splinting and consistently reported greater discomfort [4,9,10]. Conversely, Campbell et al. suggested greater benefit when surgery involved both nasal walls, and Stępiński and Banaszewski found a marked protective association in routine clinical practice [3,8]. These findings support a selective strategy: splints may be justified when opposing mucosal surfaces have been injured, when septoplasty is combined with turbinate surgery, or when the surgeon judges the risk of mucosal contact to be high. They are less clearly justified after uncomplicated, limited septal surgery with intact mucosal flaps.

Differences in splint design may also be important. Thick or rigid devices may increase pain, pressure, crusting, and mucosal irritation, whereas thin Silastic separators may provide sufficient mechanical separation with less morbidity [11,12,13]. Future studies should report the splint material, thickness, fixation method, duration of placement, concomitant packing, and postoperative cleaning protocol, as these variables may materially affect outcomes.

Transseptal suturing is a reasonable alternative to routine non-absorbable packing. It may stabilize the mucosal flaps while avoiding pressure-related injury and painful packing removal. However, the evidence regarding adhesion prevention remains inconsistent, and the additional operative time must be considered [1,14,15,16]. Similarly, the findings concerning packing suggest that material-related trauma may be more important than the mere presence of a dressing. The association between seton gauze and synechiae in the Stępiński cohort, together with the findings of Dutta et al., supports the use of less traumatic materials and careful removal techniques [3,18].

Postoperative care remains an essential component of prevention. Irrigation reduces retained clots and crusts that may maintain contact between damaged surfaces. Hypertonic seawater produced better clinical outcomes than the comparator solutions in one randomized study after septoplasty with radiofrequency turbinate treatment [19]. Nevertheless, the optimal solution, concentration, volume, frequency, and duration of irrigation remain uncertain.

One study compared polyethylene septal splints, fixed with transseptal sutures and stabilized by a stainless-steel spring clip, with conventional rubber glove nasal packing. Although the use of polyethylene splints was associated with a lower frequency of postoperative intranasal synechiae, the difference between the groups was not statistically significant [20].

Endoscopic septoplasty may reduce tissue trauma through improved visualization and precise treatment of localized deformities. The available comparative literature favors the endoscopic approach for overall complications, including adhesions, but the evidence remains vulnerable to selection bias and differences in surgeon experience [7]. The key preventive principle is therefore not endoscopy alone, but the reduction of unnecessary mucosal injury.

Topical mitomycin C produced a significant reduction in adhesions in a selected population with mucoperichondrial flap tears [6]. Despite the favorable result, routine use would be premature. The study included only 80 high-risk patients, assessed adhesions at one month, and did not establish long-term safety. Mitomycin C should

be viewed as a potential adjunct for carefully selected cases rather than a standard component of postoperative management.

Evidence on the management of established synechiae is particularly limited. Early adhesions may be amenable to division under local anaesthesia, but there are insufficient comparative data to define the optimal treatment of broad or recurrent adhesions. Future studies should evaluate recurrence after adhesiolysis, the role and duration of postoperative splinting, and patient-reported functional outcomes.

4.1. Limitations

This review has several limitations. It was conducted as a narrative rather than systematic review, and no formal risk-of-bias assessment or meta-analysis was performed. The search was limited to PubMed and English-language publications, although reference lists were screened manually. Several included studies were small, retrospective, or primarily designed to evaluate broader postoperative outcomes rather than synechiae specifically. Older studies used heterogeneous surgical techniques, packing materials, splint designs, and follow-up schedules. In addition, some cohorts included concomitant turbinate or sinus surgery, limiting direct attribution of adhesions to septoplasty.

5. Conclusions

Intranasal adhesions remain a clinically relevant complication of septoplasty and septoturbinateplasty. Their reported frequency varies widely, and comparisons between studies must account for differences in case selection, concomitant procedures, operative technique, postoperative management, and follow-up.

The most important preventive principles are preservation of mucosal integrity, avoidance of opposing raw surfaces, atraumatic packing, removal of clots and crusts, appropriate postoperative irrigation, and close follow-up. Septal splints should not be regarded as universally necessary; the evidence supports individualized use, particularly when bilateral mucosal injury or simultaneous surgery of the septum and lateral nasal wall creates a high risk of tissue contact. Transseptal suturing is a reasonable alternative to packing, while routine mitomycin C cannot currently be recommended.

Prospective multicenter studies using standardized definitions of synechiae, specified assessment time points, detailed reporting of splint and packing protocols, and patient-reported outcome measures are required to establish evidence-based preventive and treatment strategies.

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