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# Is the crushing method really beneficial in concha bullosa surgery?

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***ABSTRACT***

**Objectives:** This study aims to compare the effectiveness of endoscopic middle turbinate lateral resection and the crushing technique in patients undergoing surgery for concha bullosa (CB) using the Nasal Obstruction Symptom Evaluation (NOSE) scale.

**Patients and Methods:** This prospective study was performed on 60 patients who underwent surgery for isolated CB between March 2023 and February 2025. Patients were randomized into two groups according to the surgical technique: the conventional surgery group (16 males, 14 females; mean age: 39.2 ± 8.5 years; range, 18 to 60 years) and the crushing group (18 males, 12 females; mean age: 40.1 ± 7.8 years; range, 20 to 61 years). The NOSE scores were evaluated preoperatively and at the 6th postoperative month. Operative time and complications were recorded. A $p$-value < 0.05 was considered statistically significant.

**Results:** Both groups showed significant improvement in postoperative NOSE scores compared with preoperative values ($p$ < 0.001). There was no significant difference between groups regarding symptom improvement ($p$ > 0.05). The mean operative time was significantly shorter in the crushing group (5 ± 3 min) compared with the lateral resection group (23.4 ± 6 min) ($p$ < 0.05). Synechiae occurred in four (13.3%) patients in the lateral resection group and seven (23.3%) patients in the crushing group. Recurrence was observed only in the crushing group (two patients, 6.7%). No major postoperative hemorrhage or cerebrospinal fluid leak was detected.

**Conclusion:** Both techniques provide comparable symptomatic improvement in CB surgery. The crushing technique offers the advantage of shorter operative time and may be considered an effective, minimally invasive alternative in appropriately selected patients.

***Keywords:*** Concha bullosa, crushing, endoscopic surgery, lateral resection, middle turbinate, NOSE score.

The middle turbinate is one of the important anatomical structures originating from the lateral nasal wall and perform various functions such as smell perception, lamination of airflow, and warming and humidifying inhaled air.[1] Various anatomical variations of the middle turbinate have been described, with concha bullosa (CB), i.e., pneumatization of the turbinate, being the most common variation.[2]

Concha bullosa is a radiological diagnosis and is usually found incidentally on computed tomography (CT).[3] A review of the literature shows that the incidence of CB ranges from 14 to 53%. Not only the anatomy but also the pathophysiology of CB has been studied in detail. The middle turbinate regulates nasal airflow in a parabolic manner while protecting the middle meatus by medially confining it. It also assists in the thermal and humidification of inspiratory air and facilitates nasal discharge.[4] Concha bullosa is generally an asymptomatic condition that does not require treatment. However, surgical intervention

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may be necessary when it causes nasal congestion, chronic sinusitis, headaches, and impaired sense of smell.

Various surgical techniques have been described for the treatment of CB-causing complaints, including partial lateral resection, total resection, conchapexy, and crushing.[5-7] However, there is no clear consensus on the best surgical technique, and questions remain regarding where and how much of the middle concha should be removed.

The aim of this study is to compare the effectiveness of endoscopic middle turbinate lateral resection and crushing methods applied in CB patients using the Nasal Obstruction Symptom Evaluation (NOSE) scale.

## PATIENTS AND METHODS

This prospective study was conducted at the Department of Otolaryngology, Kocaeli Health and Technology University, Medar Gölcük Hospital between March 2023 and February 2025. A total of 60 participants who applied with complaints of nasal congestion and headache, were diagnosed with CB based on the findings of nasal endoscopic examination and paranasal CT, and were scheduled for surgical treatment were included in the study and divided into two groups: the conventional surgery group (16 males, 14 females; mean age: 39.2 ± 8.5 years; range, 18 to 60 years) and the crushing group (18 males, 12 females; mean age: 40.1 ± 7.8 years; range, 20 to 61 years). Patients over 18 years of age who underwent endoscopic surgery for isolated middle turbinate bullosa and completed the preoperative and postoperative NOSE scale were included in the study. Conversely, individuals who have undergone maxillofacial trauma and nasal surgery, those with inferior turbinate hypertrophy, adenoid hypertrophy, paranasal sinus disease, septal deviation, nasal valve collapse, smokers, systemic disease, conditions causing nasal obstruction, such as nasal malignancy, pregnant women, and those who did not accept the postoperative follow-up protocol were excluded from the study. All surgical interventions for CB were performed by the same surgeon under general anesthesia. A written informed consent was obtained from each patient. The study protocol was approved by the Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (Date: 02.01.2026, No. 2026-01-08). The study was conducted in accordance with the principles of the Declaration of Helsinki.

*Lateral concha bullosa resection surgery (classic group):* While the patient was under general anesthesia, epinephrine was injected into the middle concha at a ratio of 1:100,000 prior to surgery. The CB intervention was performed using a 4 mm, 0-degree rigid telescope (Karl Storz, Tuttlingen, Germany). The incision was made into the concha using a moon knife at the point where pneumatization was most prominent, and the incision was completed by turning the moon knife tip upward to the point of concha attachment. Care was taken not to apply excessive pressure when entering the concha. In cases where the concha lamella was very thick, the incision was continued with concha scissors to the posterior border of pneumatization. The lateral lamella of the middle concha was grasped with straight forceps and removed with a slight rotational movement. After lateral resection, a sinus pack tampon was placed in the surgical field to control bleeding.

*Crushing surgery (crushing group):* All patients underwent general anesthesia, and topical vasoconstriction was achieved using a 4 mm, 0-degree rigid telescope with an epinephrine injection at a ratio of 1:100,000. Then, the pneumatized middle turbinate was crushed from the upper connection to the lower part and from front to back using Blakesley forceps, and the procedure was completed without mucosal damage. No tamponade was required after the crushing procedure. Pre- and postoperative images of one of our patients in the crushing group are shown in Figure 1.

Patients' demographic data, complications, and operation times were recorded. Patients included in the study were evaluated using the NOSE scale preoperatively and at six months postoperatively.

One of the most commonly used methods for subjectively evaluating functional outcomes is the NOSE scale, developed by Stewart et al.[8] This scale is a measure consisting of five questions that assess nasal breathing function. Our patients were asked to assign a score from 0 to 4 to each question. The scores given to all questions were added together and multiplied by 5 to make the evaluation easy and understandable, resulting in a value ranging from a minimum of zero to a maximum of 100. A low score indicates good nasal function, while a high score indicates poor function, as shown in Table 1.

### Statistical analysis

Statistical analyses were performed using the SPSS version 13.0 software (SPSS Inc., Chicago, IL, USA) , with the Wilcoxon signed-rank test and t-test. Significance was assessed at the $p < 0.05$ level.

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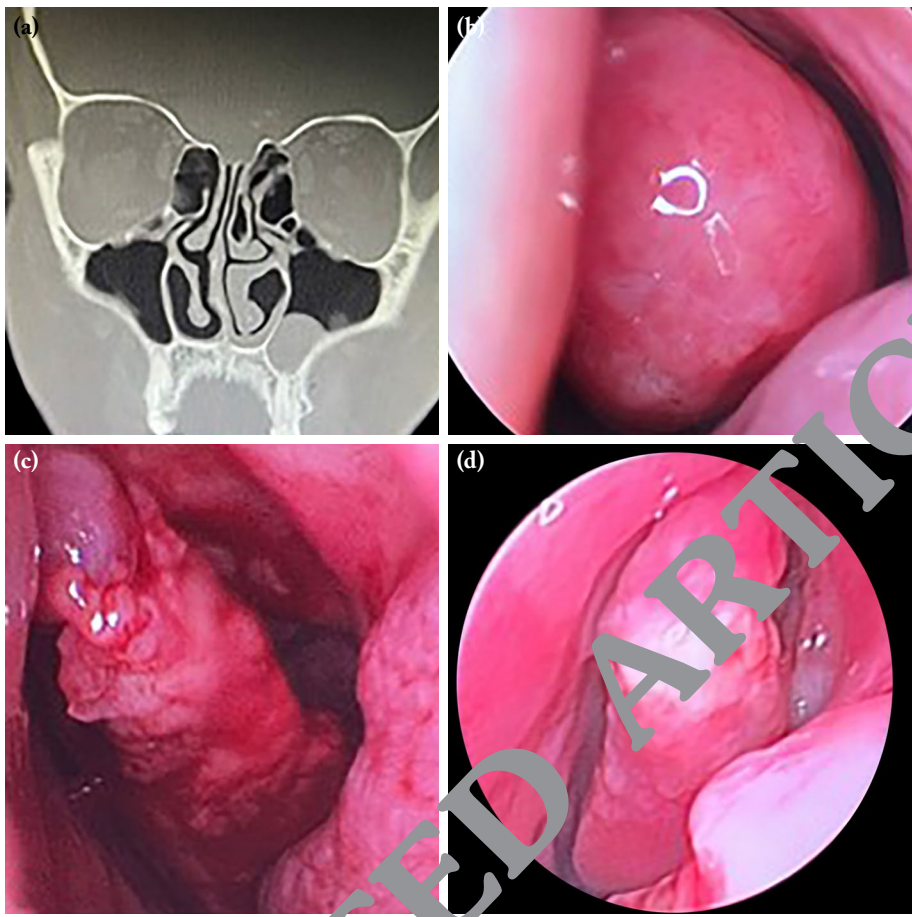



**Figure 1.** **(a)** Left concha bullosa, **(b)** preoperative view, **(c)** intraoperative view, **(d)** postoperative first month view.

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## RESULTS

The groups were similar in terms of age, sex, and body mass index, as shown in Table 2, and there was no statistically significant difference between them ($p > 0.05$). The most common complaints for referral were nasal congestion and headache.

When evaluated in terms of operation time, the average surgical time was 23.4 ± 6 minutes in the conventional surgery group and 5 ± 3 minutes in the crushing group. The difference between the groups was statistically significant ($p < 0.05$). The operation time was shorter in the crushing group compared to the conventional group.

When preoperative and postoperative NOSE scores were compared, a significant decrease in postoperative NOSE scores was observed in both

**Table 1.** Over the last month or longer, how much of a problem have the following conditions been for you? Please select the most appropriate answer

| | No problem | Very mild problem | Moderate problem | Severe problem | Very severe problem |
|---|---|---|---|---|---|
| Nasal swelling and fullness | 0 | 1 | 2 | 3 | 4 |
| Nasal obstruction | 0 | 1 | 2 | 3 | 4 |
| Difficulty breathing through the nose | 0 | 1 | 2 | 3 | 4 |
| Trouble sleeping | 0 | 1 | 2 | 3 | 4 |
| Inability to breathe comfortably the nose during exercise or exertion | 0 | 1 | 2 | 3 | 4 |

**Table 2.** Demographic characteristics of the groups

| | Classical group | | Crushing group | |
|---|---|---|---|---|
| | n | Mean ± SD | n | Mean ± SD |
| Age (mean) | | 39.2 ± 8.5 | | 40.1 ± 7.8 |
| Sex | | | | |
| Male | 16 | | 18 | |
| Female | 14 | | 12 | |
| BMI (mean) | | 24.3 ± 3.2 | | 23.1 ± 3.1 |

SD, standard deviation; BMI, body mass index.

**Table 3.** NOSE scores

| | Preoperative NOSE score | Postoperative NOSE score |
|---|---|---|
| | Mean ± SD | Mean ± SD |
| Classical group | 53.5 ± 4.2 | 11 2.5 |
| Crushing group | 49.8 ± 3.9 | 1 ± |

NOSE, nasal obstruction symptom evaluation; SD, standard deviation.

groups, as shown in Table 3. When NOSE scores were examined before and after surgery in the conventional group, there was a statistically significant difference ($p < 0.001$). When preoperative and postoperative NOSE scores were examined in the crushing group, there was a statistically significant difference ($p < 0.0001$). There was no statistically significant difference in terms of improvement in NOSE scores between the classic and crushing groups ($p > 0.05$).

When evaluated in terms of complications, synechia was observed in four of 30 patients (13.3%) who underwent lateral resection, while this rate was observed in seven of 30 patients (23.3%) in the crushing group. Middle concha instability was not observed in the crushing group, while it was observed in only one of 30 patients (3.3%) in the lateral resection group. Re-pneumatization (recurrence) was not observed in any of the 30 patients who underwent lateral resection (0%), while it was observed in two of the 30 patients who underwent crushing (6.7%). No major postoperative bleeding or cerebrospinal fluid leakage was observed in either group. No complications required surgical intervention.

## DISCUSSION

Concha bullosa is a common anatomical variation of the osteomeatal region.[2] It is easily detected by CT, revealing an air space within the oval bone ring of the middle concha.[3] Enlarged CB may compress the uncinate process, obstruct the infundibulum, and impair mucociliary clearance, leading to ethmoid and maxillary sinus diseases.[6] Concha bullosa can be unilateral or bilateral and is often accompanied by septal deviation toward the opposite side. It can cause various symptoms such as nasal obstruction, postnasal drip, loss of smell, and headache.[3,9] Surgical indications for the middle concha, which is pneumatized, include causing infection and airway obstruction, closure of the osteomeatal passage, and contact headache.[10] Approximately one-third of CB cases may play a role in the etiology of sinusitis, while the remaining two-thirds are treated due to their contribution to headache and nasal congestion.[11]

The effectiveness of techniques used in CB surgery has been debated for many years. Lateral partial concha resection is a more radical method and provides significant symptomatic improvement, especially in large bullous lesions. The crushing technique, on the other hand, is advantageous due to its mucosal preservation, short operation time, and low complication rates.[12]

Davis et al.[13] reported in their study that lateral resection is the most commonly used surgical method in CB surgery. They concluded that this method is more effective in providing adequate airflow in the treatment of large CBs that completely fill the osteomeatal complex.

In their study, Eren et al.[14] reported that the crushing technique is a less invasive method that can

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be applied more quickly and easily and that nasal anatomy and physiology are better preserved in this surgical intervention.

According to the results of the study conducted by Tanyeri et al.[15] CB crushing technique is an easy and conservative treatment method. Since CB does not recur after crushing, they concluded that this technique can be considered a definitive treatment.

Koçak et al.[12] treated 71 patients with CB using the crushing method and concluded that there were no recurrences in their long-term follow-ups. They also demonstrated that this method is a simple and safe technique that can be effectively used in all types of CB.[12]

There are several limitations to this study. In this study, only symptom scores were used as the clinical assessment method. Additionally, other important limitations of the study include the absence of objective assessment methods, such as rhinomanometry and acoustic rhinometry, and the lack of a cost assessment for the implementation of the proposed method in clinical evaluations.

In conclusion, according to the results of our study, the rates of symptom reduction in patients undergoing crushing were the same as in patients undergoing classic lateral resection. However, the operation was much shorter in patients undergoing the crushing method. Another advantage was that no tamponade was required in the crushing group. The complication rates were found to be similar to those in the lateral resection group. The crushing technique is less invasive, easier to perform, and more advantageous in terms of operation time. Therefore, the crushing technique may be the primary choice for CB surgery in appropriate indications.

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