

## Topical application versus intratubinate injection of botulinum toxin type A in the treatment of noninfectious chronic rhinosinusitis

NasIshah G. Kazem

*Department of Otorhinolaryngology, Faculty of Medicine, Benha University, Benha*

Mohamed A. Elsaid

*Department of Otorhinolaryngology, Faculty of Medicine, Benha University, Benha*

Aya L. Hassan

*Department of Otorhinolaryngology, Qaha Central Hospital, Qalubia, Egypt*

Abdelrahman A. Abdelalim

*Department of Otorhinolaryngology, Faculty of Medicine, Benha University, Benha,*  
abdelrahman.ahmed@fmed.bu.edu.eg

Follow this and additional works at: <https://pajr.researchcommons.org/journal>



Part of the [Otolaryngology Commons](#), and the [Otorhinolaryngologic Diseases Commons](#)

---

### Recommended Citation

Kazem N, Elsaid M, Hassan A, et al. Topical application versus intratubinate injection of botulinum toxin type A in the treatment of noninfectious chronic rhinosinusitis. Pan Arab J. Rhinol. 2023; 2022; 12 : 19-24.

Available at: <https://pajr.researchcommons.org/journal/vol12/iss1/5> DOI: <https://doi.org/10.58595/2090-7559.1002>

This Original Study is brought to you for free and open access by Pan Arab Journal of Rhinology (PAJR). It has been accepted for inclusion in Pan Arab Journal of Rhinology by an authorized editor of Pan Arab Journal of Rhinology (PAJR).

# Topical Application Versus Intraturbinate Injection of Botulinum Toxin Type A in the Treatment of Noninfectious Chronic Rhinosinusitis

Naslshah G. Kazem<sup>a</sup>, Mohamed A. Elsaid<sup>a</sup>,  
Aya L. Hassan<sup>b</sup>, Abdelrahman A. Abdelalim, MD<sup>a,\*</sup>

<sup>a</sup> Department of Otorhinolaryngology, Faculty of Medicine, Benha University, Benha, Egypt

<sup>b</sup> Department of Otorhinolaryngology, Qaha Central Hospital, Qalubia, Egypt

## Abstract

**Background:** Chronic rhinosinusitis is a very common disorder caused by chronic inflammation or irritation of nasal mucosa.

**Objectives:** The purpose of this study was to evaluate the efficacy and safety of topical application of botulinum toxin type A (BTX-A) compared with intraturbinate injection for the treatment of noninfectious chronic rhinosinusitis.

**Patients and methods:** This prospective comparative study was carried out on 30 patients with noninfectious chronic rhinosinusitis. Patients were divided randomly into two groups. BTX-soaked merocel was applied topically in group A (topical group), which included 15 patients. Intraturbinate BTX injection was applied in group B (injected group), which included 15 patients. The total nasal-symptom score (TNSS) was applied initially and after the procedure for 8 weeks of follow-up period.

**Results:** Both groups showed significant improvement of the TNSS all over the period of the study compared with the baseline, except at the eighth week in group A (topical group). At the eighth week, the TNSS was significantly higher in group A than group B, median (range) of 8 (4–11) compared with 5 (3–6), *P* value was less than 0.001. No one complained from epistaxis and only three patients in group B reported nasal-dryness sensation at the fourth and sixth weeks and improved by the eighth week.

**Conclusion:** BTX-A topical application using soaked merocel could be a safe and a very successful way for managing the symptoms of chronic noninfectious rhinosinusitis. However, injections had a longer duration of impact than topical application.

**Keywords:** Allergic rhinitis, Botulinum toxin, Noninfectious rhinosinusitis, Vasomotor rhinitis

## 1. Introduction

Chronic rhinosinusitis is a chronic inflammation of the nasal cavity lining the mucosa, characterized by nasal congestion, rhinorrhea, and itching. It affects ~20% of the population and has different etiologies, including idiopathic, infectious, allergic, occupational, drug-induced, hormonal, and others [1].

The idiopathic rhinitis is one type of the noninfectious rhinosinusitis (also known as intrinsic, or in former times as vasomotor rhinitis). This type can

be diagnosed by exclusion and has not been as extensively investigated as allergic rhinitis [2].

Vasomotor rhinitis, which accounts for over half of all chronic rhinosinusitis cases, is unrelated to allergy, infection, structural lesions, systemic illness, or substance addiction [2]. Although the exact cause of vasomotor rhinitis is unknown, it is believed that the imbalance of the sympathetic, parasympathetic, and nociceptive nerves that innervate the nasal mucosa is the main cause of this entity [3]. When mediators are out of balance, increased vascular permeability and mucus production from the submucosal nasal glands occur [4].

Received 29 October 2021; accepted 22 January 2022.

Available online 16 January 2023

\* Corresponding author. Department of Otorhinolaryngology, Faculty of Medicine, Benha University, Benha 13512, Egypt. Tel.: +201069372609. E-mail address: [abdelrahman.ahmed@fmed.bu.edu.eg](mailto:abdelrahman.ahmed@fmed.bu.edu.eg) (A.A. Abdelalim).

<https://doi.org/10.58595/2090-7559.1002>

2090-7559/© 2023 Pan Arab Rhinology Society. This is an open access article under the CC-BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Another kind of noninfectious rhinosinusitis is allergic rhinitis, which is described as nasal mucous-membrane irritation caused by exposure to allergens [5]. It is a common and disturbing disorder that affects patients' quality of life. It causes a great economic burden on the healthcare system [6].

Botulinum toxin (BTX), which is extracted from the purified toxin of *Clostridium botulinum* bacteria, is a natural neuroparalytic agent [7]. Botulinum toxin type A (BTX-A) is a neurotoxin, it works by inhibition of the acetylcholine release from the presynaptic nerve endings at the neuromuscular and neuroglandular junction [8]. In the treatment of allergic rhinitis, the intranasal injection of BTX-A can be effective due to its anticholinergic properties of BTX-A, which affect the large number of serous nasal glands, and result in decreased nasal secretory response [9], also, it inhibits the release of acetylcholine from the preganglion cholinergic nerve endings in the sphenopalatine ganglion and causes apoptosis of nasal glands [10].

Recently, Botox has been widely used in many medical and surgical therapeutic uses. This has been aided by a greater understanding of its underlying physiology as well as improved efficacy and safety [11].

The purpose of this research is to evaluate the efficacy and safety of topical application of BTX-A versus intraturbinate injection in controlling the symptoms of noninfectious chronic rhinosinusitis.

## 2. Patients and methods

### 2.1. Study design and patients

Between November 2019 and July 2021, a randomized prospective clinical research was conducted. Thirty patients were analyzed in the trial and were selected among those attending the outpatient clinic presenting with symptoms of chronic noninfectious rhinosinusitis not responding to previous lines of treatment, including antihistaminic, nasal decongestant, and/or steroid nasal spray.

The study protocol was approved by the corresponding ethical committee and informed written consents were obtained from all patients to participate in this study.

Adult patients (18 years or older) with persistent chronic noninfectious rhinosinusitis who had not responded to earlier lines of therapy were included in the trial. Pregnants, lactating, and patients with a history of systemic illness, such as diabetes mellitus, hypertension, or malignancy, were excluded from the study. Additionally, individuals who have had

previous nasal surgery, such as turbinate-reduction procedure or septoplasty, were excluded from the study. We excluded patients diagnosed with major structural deformities (nasal septal deviation, turbinate hypertrophy, adenoid hypertrophy, nasal-valve pathology, or nasal polyps) and patients having symptoms consistent with acute rhinosinusitis (purulent or mucopurulent nasal discharge).

Also, we excluded patients with radiological findings of nasal tumors or fungal sinusitis. The study did not include patients with any accompanying disease that might be aggravated by anticholinergic therapy such as glaucoma, prostate hypertrophy, or myasthenia. Additionally, participants having a history of allergy to Botox or local anesthetic drugs were excluded from the trial. The study did not include patients who were receiving any systemic or local corticosteroid, or those with a history of use within 1 month preceding the initial assessment.

### 2.2. Initial assessment and evaluation

All selected patients were subjected to a thorough clinical assessment, including complete history taking, full general, and otorhinolaryngological examination. History was recorded with special concerns to the symptoms of chronic noninfectious rhinosinusitis (rhinorrhea, nasal obstruction, sneezing, and itching). These symptoms were scored by the patient on a four-point scale (0 none, 1 mild, 2 moderate, or 3 severe) by using the self-administered questionnaire and total nasal-symptom score (TNSS).

Anterior rhinoscopy and nasal endoscopy were performed in all patients to evaluate the nasal cavity. Prior to initiating the intervention, all patients had standard computed-tomography scans of the nose and paranasal sinus coronal slices to rule out any additional nasal disease.

### 2.3. Preparation of botulinum toxin type A and intervention

BTX-A is available in the form of a 100-U powder vial. The vial was dissolved in 10 ml of saline to yield a clear colorless solution containing 10 U/ml. The patients were randomly assigned to one of two groups: group A (topical group) consisted of 15 patients who received topical BTX in the form of merocel soaked in 20 U of BTX (2 ml). For 30 min, one moistened merocel was inserted on each side of the nasal cavity.

Group B (injected group) consisted of 15 patients subjected to intraturbinate BTX-A injection. Twenty

units of BTX-A (2 ml) were submucosally injected into each inferior turbinate using an insulin-syringe needle after local anesthesia with 10% xylocaine spray in the sitting posture. BTX-A was injected slowly over 5 min on each side.

#### 2.4. Follow-up

The patients were evaluated and followed up for the possible adverse effects, including epistaxis during the first week. The patients' main four symptoms were evaluated and scored by the same previously applied TNSS in the outpatient clinic at 1, 2, 4, 6, and 8 weeks after the intervention. Also, nasal dryness as a possible side effect was recorded at the same follow-up visits.

The clinical examination (anterior rhinoscopy and nasal endoscopy) was done in every follow-up visit. All patients were advised not to take any additional anti-allergy drugs or to have surgery.

#### 2.5. Statistical analysis

Data management and statistical analysis were done using SPSS vs. 25 (IBM, Armonk, New York, USA). Numerical data were assessed for normality using the Shapiro–Wilk test and direct data-visualization methods. Then, numerical data were summarized as means and SDs or medians and ranges. Categorical data were summarized as numbers and percentages. Comparisons between both groups were done using independent *t* test or Mann–Whitney *U* test for normally and non-normally distributed numerical data, respectively. Within groups, comparisons were done using Friedman's test. Post-hoc analysis was done using Bonferroni's method. Categorical data were compared using the  $\chi^2$  test or Fisher's exact test if appropriate. All *P* values were two-sided. *P* values less than 0.05 were considered significant.

### 3. Results

The study included a total of 36 adult patients who were randomly assigned to one of two groups. Six patients dropped out of the study during the follow-

up period, and 15 patients were enrolled and finally analyzed in each group. Thirty adult patients were enrolled and studied in total: 10 were male (six in group A and four in group B) and 20 were female (nine in group A and 11 in group B). In group A, the mean  $\pm$  SD of age was  $33 \pm 7$  years, and in group B, it was  $31 \pm 7$  years. There were no significant differences between both groups regarding age and sex. *P* values of 0.343 and 0.439 were obtained, respectively.

As demonstrated in Table 1, as regards nasal-symptom scores at the initial assessment, there was no statistically significant difference between both groups, the median (range) of TNSS was 9 (5–11) in group A and 10 (7–12) in group B (*P* = 0.367). Table 1 shows the comparison between both groups regarding the four main symptoms at the initial time of the presentation before the intervention showing no statistically significant difference between both groups.

Table 2 compares the TNSS between both groups at different follow-up times all over the period of the study; at the eighth week, the TNSS was significantly higher in group A than group B, median (range) of 8 (4–11) compared with 5 (3–6), *P* value was less than 0.001. Within both groups, TNSS significantly improved all over the period of the study compared with the baseline TNSS, except at the eighth week in group A (topical group), which showed a nonsignificant difference when compared with the baseline preintervention TNSS.

As shown in Table 3, there were no significant differences between both groups regarding each symptom score and TNSS at all follow-up visits all over the period of the study, except at the eighth week, all symptoms and TNSS showed significant differences between the two groups.

As regards the side effects discussed with the patients in the form of epistaxis during the first week of the intervention and nasal dryness all over the follow-up period, no one complained from epistaxis and only three patients in group B (injected group) noticed nasal-dryness sensation at the fourth and sixth weeks of the follow-up period (*P* = 0.224) and improved by the eighth week.

Table 1. Comparison between both groups regarding nasal symptoms and total nasal-symptom score at the initial time of presentation.

Nasal symptoms		Group A (N = 15)	Group B (N = 15)	<i>P</i> value
Obstruction	Median (range)	3 (2–3)	3 (2–3)	0.775
Rhinorrhea	Median (range)	2 (1–3)	3 (2–3)	0.461
Sneezing	Median (range)	2 (1–3)	2 (1–3)	0.089
Itching	Median (range)	2 (1–3)	2 (1–3)	0.838
TNSS	Median (range)	9 (5–11)	10 (7–12)	0.367

TNSS, total nasal-symptom score.

Table 2. Total nasal-symptom score in both groups at different follow-up visits.

	Group A (N = 15)	Group B (N = 15)	P value
Preintervention	9 (5–11)	10 (7–12)	0.367
At 2 weeks	5 (2–6) <sup>a</sup>	5 (3–7) <sup>a</sup>	0.967
At 4 weeks	5 (2–6) <sup>a</sup>	4 (2–6) <sup>a</sup>	0.389
At 6 weeks	5 (2–6) <sup>a</sup>	5 (2–6) <sup>a</sup>	0.25
At 8 weeks	8 (4–11)	5 (3–6) <sup>a</sup>	<0.001
P value	<0.001	<0.001	

Mann–Whitney *U* test was used between groups. Friedman's test was used within groups. Post-hoc analysis within each group was done.

<sup>a</sup> Significant difference compared with the baseline pre-intervention measure.

#### 4. Discussion

BTX is a neurotoxin produced by the Gram-positive anaerobic bacterium *C. botulinum*. It inhibits the release of acetylcholine from presynaptic nerve ends, impairing signal transmission at the neuromuscular and neuroglandular junctions [12].

Numerous writers have recently explored a unique method of controlling rhinosinusitis symptoms by administering a single dose of BTX-A with the results lasting from weeks to months. BTX-A has been used in different studies to treat noninfectious chronic rhinosinusitis patients with either intrinsic or extrinsic types and it could effectively reduce the symptoms. The nasal-cavity delivery of BTX was accomplished through direct injection into the middle or inferior turbinates [13–15]. We aimed in this study to compare the efficacy of topical BTX-A administration using soaked merocel and its intraturbinate injection as a treatment option for noninfectious chronic rhinosinusitis patients.

Before treating the patients, we had to decide which dose of BTX-A should be applied. A dose of 20 U was selected in our study as a balance between safety and efficacy after consideration of preceding studies. It was safely below the dosage utilized by Braun et al. [9] and Ünal et al. [16] (60 and 80 U, respectively), and also likely to reproduce the effects of improving congestion and itching as seen on dosages above 12 U in the study of Ozcan et al. [17].

In our study, we found that BTX-A topical application using soaked merocel (20 U on each side) was as effective as its injection in the inferior turbinate (20 U on each side) in controlling the symptoms of rhinitis up to the sixth week, then the topical application showed lesser effects regarding each symptom score and the TNSS. In both groups, TNSS significantly improved all over the period of the study compared with the baseline TNSS, except at the eighth week in group A (topical group), which showed a nonsignificant difference when compared with the baseline preintervention TNSS.

In the study of Nowak and Szyfter [18], 10 patients with chronic intrinsic rhinitis received injections of BTX-A in a dose of 20 U in the inferior and the middle turbinates, two patients were applied to 40 U of Botox in the influenced merocel. All patients had an improvement of all rhinitis symptoms for 8–12 weeks. They observed no significant differences between both groups regarding improvements and side effects at different follow-up times. However, that research has several limitations due to the small sample size.

In agreement with our results, Zhang et al. [13] showed significant improvement of the TNSS in allergic rhinitis patients after BTX-A intranasal injection compared with the pre-injection score with the greatest effect that was in rhinorrhea, sneezing, nasal congestion, and itching subscales, so they concluded that BTX-A has clear effectiveness in alleviating the symptoms of both intrinsic and allergic rhinitis, and has a favorable safety profile, and duration of action. This is similar to the results of group B in our study (injected with 20 U of BTX-A submucosally in the inferior turbinate of both sides of the nose).

Our results in group B match with Sapci et al. [19], who studied 38 patients with idiopathic rhinitis without eosinophilia. They detected that BTX-A displayed its maximum effects in the second week. It was effective for 8 weeks and then showed a prominent decrease in the effect after the eighth week. Also, it matches with Ünal et al. [16], who studied 34 patients to assess the effectiveness of 20

Table 3. P values between the studied groups regarding different symptoms at the initial time of presentation and all follow-up visits.

	Preintervention	Follow-up visits			
		2 weeks	4 weeks	6 weeks	8 weeks
Obstruction	0.775	1	0.267	0.161	0.013 <sup>a</sup>
Rhinorrhea	0.461	0.595	0.595	0.806	0.007 <sup>a</sup>
Sneezing	0.089	0.137	0.305	0.461	0.019 <sup>a</sup>
Itching	0.838	0.217	0.217	0.325	0.023 <sup>a</sup>
TNSS	0.367	0.967	0.389	0.25	<0.001 <sup>a</sup>

TNSS, total nasal-symptom score.

<sup>a</sup> Significant.



and 30 U of BTX-A injection on each side and stated that rhinorrhea, nasal obstruction, and sneezing scores showed improvements at all time points.

Our results as regards BTX-A injection in group B also match with Abdelfattah and El-Moselhy [20], who studied 50 patients with allergic rhinitis using a single intranasal injection dose of BTX-A. There was a statistically significant decrease of symptom-severity score of obstruction, rhinorrhea, sneezing, itching, and the TNSS by the end of the follow-up period. It gave results like Fexofenadine (once/day), and the intranasal steroid spray (Triamcinolone, once/day).

Our results in group A (BTX-A topical application using soaked merocel) (20 U on each side) go in line with the case report of Rohrbach and Laskawi [10] who inserted 20 U of BTX-A into each nostril using a small sponge in close contact with the inferior and middle turbinates. The effect was scored by the patient and by rhinomanometry. Nasal hypersecretion diminished clearly after 5 days and the rhinomanometric flow increased after 2 weeks. They concluded that this minimal invasive method of local BTX application might be a very effective and safe option for the treatment of nasal hypersecretion of different etiologies. But they did not compare the duration of effectiveness between topical application using soaked merocel and the intratubinate injection.

Our results in group A agree with Zand et al. [14], who used intranasal BTX-A-impregnated gelfoam (40 U on each side) placed in the middle meatus of each nostril. They found that the mean scores for sneezing, rhinorrhea, nasal congestion, and nasal itching significantly decreased after the treatment without reported side effects. We achieved comparable improvement results using lower doses (20 IU).

In contrast to our results, Piroimchai et al. [21] studied the effect of 40, 30, and 20 IU of BTX-A injection at the inferior turbinate in patients with persistent allergic rhinitis. Their results regarding the dose of 20 IU, showed only nasal congestion and loss of smell improvement. This mismatching with our results may be due to their enrollment of only allergic rhinitis patients and excluding of vasomotor rhinitis.

Regarding the adverse events, which included epistaxis during the first week after the injection and nasal dryness throughout the study's duration, our results in group B match with Yang et al. [22], additionally, they reported no adverse events such as nasal dryness, epistaxis, or muscle palsy. Additionally, it is consistent with the findings of Ünal et al. [16], who found that turbinate injection of 40 or 60 U of BTX-A decreased symptom scores for rhinorrhea,

nasal obstruction, and sneezing for 8 weeks without reported complication and side effects.

As regards the side effects in group A, our results match with Rohrbach and Laskawi [10] who used a sponge studded with 20 U of BTX-A for 30 min on each side of the nasal cavity in a female patient with idiopathic rhinitis. They reported that rhinorrhea, nasal obstruction, and sneezing symptoms improved with BTX-A treatment, with some nasal dryness occurring on occasion.

Regarding epistaxis as a side effect, our results were to some extent better than Abtahi et al. [23] who compared the septal injection with inferior turbinate injection of BTX-A in patients with allergic rhinitis. They reported an adverse effect during the follow-up sessions in the inferior turbinate group in four patients.

We have compared the effect of topical administration of BTX-A compared with the intratubinate injection of BTX-A through subjective assessment for 8-week duration. But further studies with a longer follow-up duration and objective-assessment method like rhinomanometry are needed to confirm our findings.

#### 4.1. Conclusion

Topical administration of BTX-A through soaked merocel (20 U on each side) may be a safe and effective technique for managing the symptoms of noninfectious chronic rhinosinusitis. It is easier than injection and less painful with a comparable effect to the intratubinate injection of BTX-A. However, the injection provided a long-lasting effect than topical application. BTX-A may be a good alternative for the treatment of noninfectious chronic rhinosinusitis patients who are unresponsive to other treatment methods.

#### Conflict of interest

There are no conflicts of interest.

#### References

- [1] Brożek JL, Bousquet J, Agache I, Agarwal A, Bachert C, Bosnic-Anticevich S, et al. Allergic rhinitis and its impact on Asthma (ARIA) guidelines-2016 revision. *J Allergy Clin Immunol* 2017;140:950–8.
- [2] Bachert C. Persistent rhinitis – allergic or nonallergic? *Allergy* 2004;59(Suppl 76):11–5. discussion 15.
- [3] Yan CH, Hwang PH. Surgical management of nonallergic rhinitis. *Otolaryngol Clin* 2018;51:945–55.
- [4] Bernstein JA. Nonallergic rhinitis: therapeutic options. *Curr Opin Allergy Clin Immunol* 2013;13:410–6.
- [5] Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens WJ, Togias A, et al. World Health Organization; GA(2)LEN; AllerGen. Allergic rhinitis and its impact on Asthma (ARIA)

- 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen). *Allergy* 2008;63(Suppl 86):8–160.
- [6] Meltzer EO, Bukstein DA. The economic impact of allergic rhinitis and current guidelines for treatment. *Ann Allergy Asthma Immunol* 2011;106(2 Suppl):S12–6.
- [7] Hashemi SM, Okhovat A, Amini S, Pourghasemian M. Comparing the effects of botulinum toxin-A and cetirizine on the treatment of allergic rhinitis. *Allergol Int* 2013;62:245–9.
- [8] Palomar FJ, Mir P. Neurophysiological changes after intramuscular injection of botulinum toxin. *Clin Neurophysiol* 2012;123:54–60.
- [9] Braun T, Gürkov R, Kramer MF, Krause E. Septal injection of botulinum neurotoxin A for idiopathic rhinitis: a pilot study. *Am J Otolaryngol* 2012;33:64–7.
- [10] Rohrbach S, Laskawi R. Minimally invasive application of botulinum toxin type A in nasal hypersecretion. *J Otorhinolaryngol Relat Spec* 2001;63:382–4.
- [11] Lang A. History and uses of BOTOX (botulinum toxin type A). *Lippincott's Case Manag* 2004;9:109–12.
- [12] Bentivoglio AR, Del Grande A, Petracca M, Ialongo T, Ricciardi L. Clinical differences between botulinum neurotoxin type A and B. *Toxicon* 2015;107:77–84.
- [13] Zhang EZ, Tan S, Loh I. Botulinum toxin in rhinitis: literature review and posterior nasal injection in allergic rhinitis. *Laryngoscope* 2017;127:2447–54.
- [14] Zand V, Baradaranfar M, Dadgarnia M, Meybodian M, Vaziribozorg S, Mandegari M, et al. The effect of gelfoam impregnated with botulinum toxin on allergic rhinitis. *Iran J Otorhinolaryngol* 2019;31:203–8.
- [15] Ozcan C, Ismi O. Botulinum toxin for rhinitis. *Curr Allergy Asthma Rep* 2016;16:1–7.
- [16] Ünal M, Sevim S, Doğu O, Vayisoglu Y, Kanik A. Effect of botulinum toxin type A on nasal symptoms in patients with allergic rhinitis: a double-blind, placebo-controlled clinical trial. *Acta Otolaryngol* 2003;123:1060–3.
- [17] Ozcan C, Vayisoglu Y, Doğu O, Görür K. The effect of intranasal injection of botulinum toxin A on the symptoms of vasomotor rhinitis. *Am J Otolaryngol* 2006;27:314–8.
- [18] Nowak K, Szyfter W. Application of botulinum toxin A in chronic intrinsic rhinitis. *Otolaryngol Pol* 2011;65:103–5.
- [19] Sapci T, Yazici S, Evcimik MF, Bozkurt Z, Karavus A, Ugurlu B, et al. Investigation of the effects of intranasal botulinum toxin type A and ipratropium bromide nasal spray on nasal hypersecretion in idiopathic rhinitis without eosinophilia. *Rhinology* 2008;46:45–51.
- [20] Abdelfattah A, El-Moselhy EA. Botulinum toxin-A, fexofenadine hydrochloride, and nasal corticosteroid (triamcinolone) spray in treatment of allergic rhinitis. *Egypt J Hosp Med* 2019;77:4861–5.
- [21] Piroonchai P, Pornnumouy W, Saeseow P, Chainansamit S. The minimum effective dose of abobotulinum toxin A injection for allergic rhinitis: a dose-escalation randomized controlled trial. *Laryngoscope Investig Otolaryngol* 2020;6:6–12.
- [22] Yang TY, Jung YG, Kim YH, Jang TY. A comparison of the effects of botulinum toxin A and steroid injection on nasal allergy. *Otolaryngol Head Neck Surg* 2008;139:367–71.
- [23] Abtahi SM, Hashemi SM, Abtahi SH, Bastani B. Septal injection in comparison with inferior turbinates injection of botulinum toxin A in patients with allergic rhinitis. *J Res Med Sci* 2013;18:400–4.