

The Allergic Rhinitis Control Test Questionnaire Is Valuable in Guiding Step-Down Pharmacotherapy Treatment of Allergic Rhinitis



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What is already known about this topic? Recent guideline recommends to consider stepping-down allergic rhinitis (AR) medications when AR is controlled. However, the criteria for stepping down are not clarified.

What does this article add to our knowledge? Our study showed that stepping-down AR medications according to Allergic Rhinitis Control Test (ARCT) scores in controlled patients led to similar clinical outcomes at reduced cost compared with those who maintained their current treatment level.

How does this study impact current management guidelines? Our study implied that the ARCT questionnaire is valuable to evaluate the stepping-down eligibility in clinical practice.

BACKGROUND: Allergic Rhinitis Control Test (ARCT) has been validated in the allergic rhinitis (AR) step-up pharmacotherapy management approach.

OBJECTIVE: The aim of our study was to evaluate the potential of ARCT in AR step-down pharmacotherapy.

METHODS: In an open-labeled randomized controlled study, patients with AR controlled with intranasal corticosteroid (INS) plus antihistamine (step 4) were included and randomized into an ARCT or a control group. In the ARCT group, the patients were followed up every 15 days; if the ARCT score was ≥ 20 (controlled AR), the patient would step down to step 3 (INS), step 2 (daily antihistamine), step 1 (antihistamine as needed), and step 0 (no medication) consecutively; if the ARCT score was strictly < 20 , the treatment would not be adjusted. In the control group, patients would be treated with step 4 medications during the whole study. Rhinitis Quality-of-Life Questionnaire (RQLQ), Morisky Questionnaire, and Brief Illness Perception

Questionnaire (B-IPQ) were completed at baseline and the end of the study. Medication use and side effects were recorded.

RESULTS: A total of 255 patients with AR were enrolled into the study; 27 patients dropped out. The control rates at day 45 were 77.8% in the ARCT group and 85.8% in the control group ($P > .05$). The ARCT group had less mean medication use than the control group (INS 1.27 vs 2.22 bottle, antihistamines 35.9 vs 61.4 tablets) ($P < .05$). RQLQ, Morisky, and B-IPQ score were significantly improved in both groups after treatment ($P < .05$). **CONCLUSIONS:** Stepping down AR medications in controlled patients led to similar clinical outcomes at reduced cost compared with those who maintained their current treatment level. ARCT is an optimal tool for evaluating the step-down eligibility. © 2019 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2019;7:272-8)

Key words: Allergic rhinitis; Allergic Rhinitis Control Test; ARIA; Quality of life; Step-down pharmacotherapy

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Allergic rhinitis (AR) is the most common allergic disease affecting 10% to 40% of the population worldwide.¹ In China, the self-reported AR in the general Chinese adult population has significantly increased during a 6-year period, becoming the most prevalent chronic disorder in China.² AR is a systemic disease affecting not only the nasal function, but general well-being as well. As a chronic condition, AR puts a considerable economic burden on sufferers.³ The treatment of AR is now well established in the Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines, and most patients respond well to the treatment. ARIA also suggest a stepwise pharmacotherapy according to initial treatment response.^{4,5} A step-up/step-down approach to AR pharmacotherapy based on patient response may hold the potential for optimal control of

Abbreviations used

AR- Allergic rhinitis
ARCT- Allergic Rhinitis Control Test
ARIA- Allergic Rhinitis and its Impact on Asthma
B-IPQ- Brief Illness Perception Questionnaire
CARAT- Control of Allergic Rhinitis and Asthma Test
CI- Confidence interval
INS- Intranasal corticosteroid
RCAT- Rhinitis Control Assessment Test
RQLQ- Rhinitis Quality of Life Questionnaire

AR symptoms while minimizing side effects and cost of treatment.

Till now, several questionnaires have been developed and validated to evaluate AR control status, including the Rhinitis Control Assessment Test (RCAT), the Control of Allergic Rhinitis and Asthma Test (CARAT), and the Allergic Rhinitis Control Test (ARCT).⁶⁻⁸ We recently validated the ARCT questionnaire—driven stepping-up approach in patients with AR.⁹ However, patients suffering from AR, asthma, and many other chronic diseases tend to consult at exacerbation phases and expect to get quick relief. To address that expectation and to increase their future adherence, the more often preferred strategy is to maximize the treatment immediately with the most powerful option and then quickly to step down in real life.¹⁰ For this reason, we designed a mirror study to further assess the potential of the ARCT questionnaire in AR stepping-down pharmacotherapy.

METHODS AND PATIENTS

Study design

This randomized controlled study was conducted in Tongji Hospital, a university hospital in Wuhan, China. It was approved by the Independent Ethical Committee of Tongji Hospital; all the patients had signed a written informed consent before the study. On the consultation day, a general questionnaire was completed by physician, including social demographic data, allergen screening, nasal cavity signs, rhinitis symptoms, history, concomitant diagnosed comorbidities (such as asthma), ARCT score, Rhinitis Quality of Life Questionnaire (RQLQ), Morisky Questionnaire,¹¹ and Brief Illness Perception Questionnaire (B-IPQ).¹² After initial screening, the patients with AR were randomized into the ARCT group or the control group. The randomization was done in blocks (6 patients in 1 block) to achieve balanced randomization in the center. The ARCT group was followed up by site visit at day 0 (D0), D45, and D60 and telephone interview at D15 and D30; the ARCT score was obtained in each visit or telephone interview. The control group was followed up by site visit at D0, D45, and D60 and telephone interview at D15 and D30. The patients were not allowed to self-adjust medication either in the ARCT group or in the control group. At D45, all the patients with AR in the 2 groups were evaluated with ARCT, medication side effects, medication use, and RQLQ. At D60, all the patients with AR were evaluated with ARCT, medication side effects, medication use, Morisky Questionnaire, and B-IPQ, and then the study was terminated.

Questionnaires

ARCT. ARCT is a 5-item questionnaire to measure the AR control level. The 5 items include the impact on professional/personal activities, sleep disturbance, medication, and overall assessment of

the disease. Each item is scored from 1 to 5, and the total score ranges from 5 to 25. A score higher than or equal to 20 is a marker of well-controlled AR.

RQLQ. RQLQ is a 36-item questionnaire to evaluate the quality of life of patients with AR, covering dimensions of activities, practical problems, nose symptoms, eye symptoms, and other symptoms. Each item is scored from “1” to “5,” “1” for “Not troubled” and “5” for “Extremely troubled.” The average score of the 36 items is calculated, ranging from “1” to “5,” “1” for “no impairment of quality of life” and “5” for “greatest impairment of quality of life.”

Morisky Questionnaire. Morisky Questionnaire is a 4-item questionnaire to evaluate the medication adherence of the patients. Each item is scored as “0” or “1,” the total score “0” for “high adherence,” “1-2” for “medium adherence,” and “3-4” for “low adherence.”

B-IPQ. B-IPQ is an 8-item questionnaire to evaluate the patient’s perception of illness. Each item is scored from “0” to “10.” Higher score represents more negative attitude to illness, whereas the scores of items 3, 4, and 7 are opposite.

Inclusion and exclusion criteria

Inclusion criteria were that the patients should be 16 to 65 years old; diagnosed as patients with AR (according to ARIA); ARCT ≥ 20 at baseline (on step 4, intranasal corticosteroid [INS] plus antihistamine); if ARCT ≤ 19 , get AR control with 2 weeks of step 4 treatment (running-in period) before randomization.

Exclusion criteria were acute upper respiratory infection (<2 weeks); infectious rhinosinusitis; chronic rhinosinusitis with nasal polyps; severe deviation of nasal septum; receiving allergen immunotherapy in past 5 years; uncontrolled AR at baseline on step 4 treatment; ARCT ≥ 20 at baseline on step 1 to step 3.

Stepping-down strategy

The study was designed as an open labeled stepwise approach for AR pharmacotherapy derived from but not fully in accord with the updated ARIA guideline. A possible step-up/step-down approach might move through 5 stages: step 0, without any medication; step 1, for mild intermittent symptoms, intranasal or oral antihistamine, as needed; step 2, daily intranasal antihistamine (an oral antihistamine or leukotriene antagonist was considered as an alternative); step 3, daily INS; step 4, combination INS and intranasal antihistamines (an oral antihistamine associated with INS was considered as an alternative).

In the ARCT group, the step-down strategy started from step 4 to the lowest possible step, even step 0 (without any medication). For every visit, if the ARCT score ≥ 20 , the patient was stepped down to the next lower step; if the ARCT score ≤ 19 , the treatment was not adjusted and the patients were re-evaluated for step-down eligibility (ARCT score ≥ 20) after 15 days. In the control group, patients were treated on step 4 and there was no adjustment during the study (Figure 1).

Outcome measures

The primary outcome was the AR control level in the ARCT group and control group at D45. Our study was designed as a noninferiority trial; the difference of AR control rate in the 2 groups within 10% will be regarded as no difference.

Secondary outcomes included the AR control level at D60; medication side effects at D45 and D60; medication use (medical cost) at D45 and D60; RQLQ score at D0 and D45; Morisky Questionnaire score at D0 and D60; and B-IPQ questionnaire at D0 and D60.

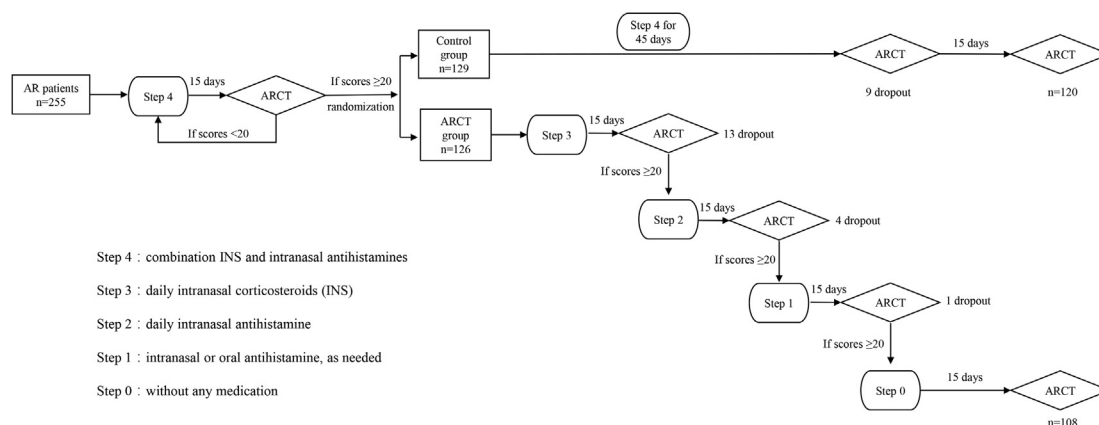


FIGURE 1. The stepping-down treatment of the AR study design. AR, Allergic rhinitis; ARCT, Allergic Rhinitis Control Test.

Statistical analysis

The study sample size formula was $N = 2PQ(U\alpha + U\beta)^2 / (P_1 + P_0)^2$, where N was the number of patients; P0 the prevalence of AR; P1 the prevalence of uncontrolled AR; $P = (P_1 + P_0)/2$; $Q = 1 - P$; and $U\alpha$ and $U\beta$ were normal distribution U values. Based on published data, the prevalence of AR in Wuhan was approximately 20%, and 10% of those patients would be uncontrolled. We calculated that the sample size should be 200 (with one-sided significance level of 2.5%, power of 80%, $U\alpha = 1.96$, $U\beta = 0.84$, $P_0 = 0.2$, $P = 0.1$, $P = 0.15$ and $Q = 0.85$). Adding 20% for dropouts, a sample of at least 240 patients was required.¹³

Descriptive parameters, such as means and standard deviations for normally distributed continuous data, while frequencies and percentages for categorical data, were calculated. The 2-sample *t* test was used to evaluate the continuous variable and the 95% confidence intervals (CIs) were generated for the AR control level and medication dosage between the 2 groups. The Pearson χ^2 test and Fisher's exact test were used to determine the association between categorical variables. All tests were performed 2-tailed, and $P < .05$ was considered statistically significant. Statistical Package for Social Sciences (SPSS version 19.0, IBM, Armonk, NY) was used for all statistical analyses.

RESULTS

Patient recruitment and characteristics

A total of 255 patients were recruited from Department of Allergy, Tongji Hospital, Wuhan, China, from July 2016 to August 2017. Of these, 126 were randomized to the ARCT group and 129 to the control group. Twenty-seven patients dropped out, 18 (14.3%) in the ARCT group and 9 (7.0%) in the control group ($P > .05$). Demographic features were comparable for the 2 groups. The allergen sensitization profiles showed no difference between the 2 groups. Among the patients, 93.7% were sensitized to house dust mite, and 80.0% were monosensitized (Table I). The treatment status in the ARCT and control groups over the 60 days of the study is described in Figure 2.

Primary outcome

AR control rate at D45. The AR control rate was 77.8% in the ARCT group and 85.8% in the control group. The difference between the 2 groups was 8.0% (95% CIs: -1.8% to 17.8%) and

was not statistically significant ($P > .05$) (Figure 3). Considering 38 pollen-sensitized patients who finished the study, we removed their data to avoid possible bias in a sensitivity analysis. The AR control levels were recalculated in the 2 group. The AR control rate was 75.5% in the ARCT group and 84.5% in the control group. The difference between the 2 groups was 9.0% (95% CIs: -2.4% to 20.4%) and was not statistically significant ($P > .05$).

Secondary outcomes

AR control rate at D60. The AR control rate was 83.3% in the ARCT group and 86.7% in the control group. There was no difference between the 2 groups ($P > .05$) (Figure 3). In the sensitivity analysis (the data of 38 pollen-sensitized patients were removed), the AR control rate was 81.9% in the ARCT group and 85.6% in the control group ($P > .05$).

Medication side effects. In the ARCT group, only 1 patient experienced chest tightness. In the control group, 5 patients experienced 5 side effects including 1 epistaxis, 3 nasal irritations, and 1 headache. More medication side effects occurred in the control group; however, the incidences of side effects were not statistically significant in the 2 groups ($P > .05$).

Medication use and cost. The use unit of INS was calculated as bottle (1 bottle was defined as a total amount of 30-day dosage of INS). As the bottle of INS was nontransparent, the INS use was measured and calculated by weighting left medication in the bottle. The antihistamine use unit was calculated as tablet (second-generation antihistamine, 1 tablet daily). The mean amount of study medication needed for treatment in the ARCT group was 1.3 bottle of INS and 35.9 tablets of antihistamine compared with 2.2 bottles of INS and 61.4 tablets of antihistamine in the control group (medication reduction amount 95% CIs: -1.1 to -0.8 for INS and -29.6 to -21.4 for antihistamine). INS and antihistamine medications were not specified in the protocol. The majority of the patients used budesonide (rhinocort) and loratadine during the study; however, some patients took other INS (fluticasone, mometasone) and antihistamine (cetirizine, olopatadine, ebastine, fexofenadine). To facilitate medication cost calculation, we converted other INS and antihistamine to equal dose of rhinocort (¥70/bottle) and loratadine (¥3.5/tablet). The mean cost of

TABLE I. Demographic and characteristics of the patients with AR

	Number (%)	ARCT group	Control group	P
Male gender	113 (44.3)	59 (46.8)	54 (41.9)	.45
Age (y)	30.5 ± 11.4	29.2 ± 11.4	31.8 ± 11.3	.07
Duration (y)	7.5 ± 6.4	7.3 ± 6.5	7.6 ± 6.3	.71
Occupation				.29
Farmer	3 (1.2)	0 (0)	3 (2.3)	
Staff	86 (33.7)	39 (31.0)	47 (36.5)	
Worker	15 (5.9)	8 (6.3)	7 (5.4)	
Student	68 (26.7)	40 (31.7)	28 (21.7)	
Unemployed	44 (17.2)	21 (16.7)	23 (17.8)	
Other careers	39 (15.3)	18 (14.3)	21 (16.3)	
Residential area				.18
Urban	227 (89.0)	116 (92.0)	111 (86.1)	
Suburbs	13 (5.1)	6 (4.8)	7 (5.4)	
Rural	15 (5.9)	4 (3.2)	11 (8.5)	
Smoking				.68
≥1 y	26 (10.2)	14 (11.1)	12 (9.3)	
No smoking	229 (89.8)	112 (88.9)	117 (90.7)	
Family history	8 (3.1)	5 (4.0)	3 (2.3)	.50
History of asthma	27 (10.6)	9 (7.1)	18 (14.0)	.10
Rhinitis graded according to ARIA				.53
Mild intermittent	20 (7.8)	12 (9.5)	8 (6.2)	
Moderate/severe intermittent	24 (9.4)	10 (7.9)	14 (10.9)	
Mild persistent	32 (12.6)	18 (14.3)	14 (10.9)	
Moderate/severe persistent	179 (70.2)	86 (68.3)	93 (72.0)	
Positive SPT, n (%)	255 (100.0)	126 (100.0)	129 (100.0)	1.00
Dust mite	239 (93.7)	122 (96.8)	117 (90.7)	.07
Animal dander	15 (5.9)	5 (4.0)	10 (7.8)	.29
Weed	27 (10.6)	9 (7.1)	18 (14.0)	.10
Tree	26 (10.2)	11 (8.7)	15 (11.6)	.54
Mold	7 (2.7)	3 (2.4)	4 (3.1)	1.0
Cockroach	22 (8.6)	9 (7.1)	13 (10.1)	.51
Mulberry silk	6 (2.4)	5 (4.0)	1 (0.8)	.12
Monosensitization	204 (80.0)	103 (81.8)	101 (78.3)	.53
Multisensitization	51 (20.0)	23 (18.3)	28 (21.7)	.53

AR, Allergic rhinitis; ARCT, Allergic Rhinitis Control Test; ARIA, Allergic Rhinitis and its Impact on Asthma; SPT, skin prick test.

treatment in the ARCT group was ¥214.6, compared with ¥370.3 in the control group. Both findings were significantly in favor of the ARCT group ($P < .001$).

RQLQ score. Substantial improvement in RQLQ was noted at D45 for both groups. In the ARCT group, the mean score changed from 1.51 at D0 to 1.08 at D45, and in the control group, from 1.53 at D0 to 1.10 at D45 ($P < .001$). The change of score was not statistically significant between the 2 groups ($P > .05$) (Figure 4).

Morisky Questionnaire score. At D60, the mean total score was 1.19 in the ARCT group and 1.45 in the control group; no statistical difference was found between the 2 groups ($P > .05$).

Brief Illness Perception Questionnaire score. Significant improvement was noted at D60 compared with baseline for both the ARCT and control groups ($P < .001$). The score for each item was not statistically significant between the 2 groups at D0 ($P > .05$); while there were differences of item 2 ($P = .049$), item

4 ($P = .045$), and item 8 ($P = .030$) at D60, other item scores showed no difference ($P > .05$) (Table II).

DISCUSSION

The optimal treatment of AR requires patient education, allergen avoidance, pharmacotherapy, and in certain patients, allergen immunotherapy. The main goal of AR, summed up in the concept of “AR control”¹⁴ may be achieved by employing reliable AR control assessment tools and by adopting a stepwise management approach that involves continuous assessment, adjustment of treatment, and review of response based on AR control. Individuals with uncontrolled AR are considered for increased medication dosage or addition of other AR treatment, which is the step-up approach. For patients whose AR is controlled, gradually stepping-down treatment to identify the minimum medication needed to maintain control is recommended. The majority of patients with AR could get control after a standard treatment proposed by ARIA,¹⁵ and a stepping-down treatment, which has the potential to reduce side effects and

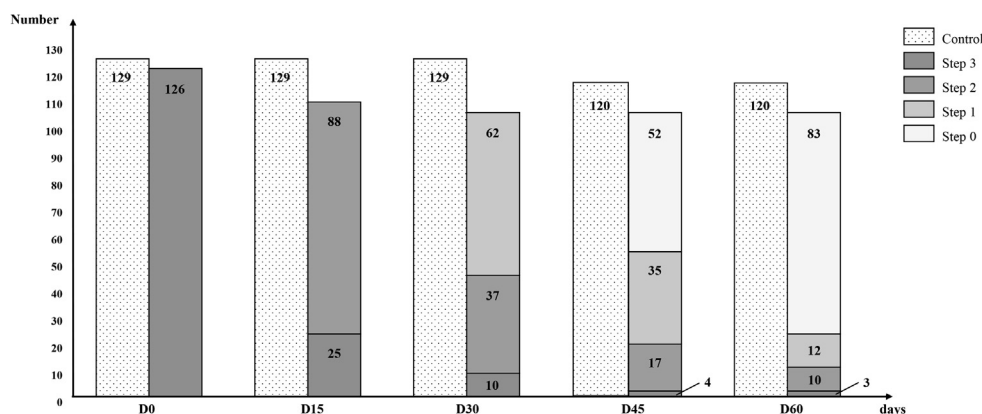


FIGURE 2. Treatment status in the ARCT group and control group over the 60 days of the study. *ARCT*, Allergic Rhinitis Control Test.

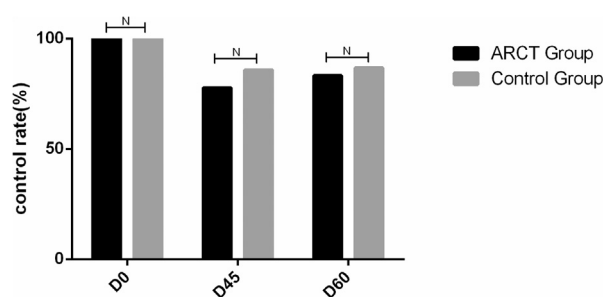


FIGURE 3. AR control level in the ARCT and control group (N : $P > .05$; control rate: rate of $ARCT \geq 20$). *AR*, Allergic rhinitis; *ARCT*, Allergic Rhinitis Control Test.

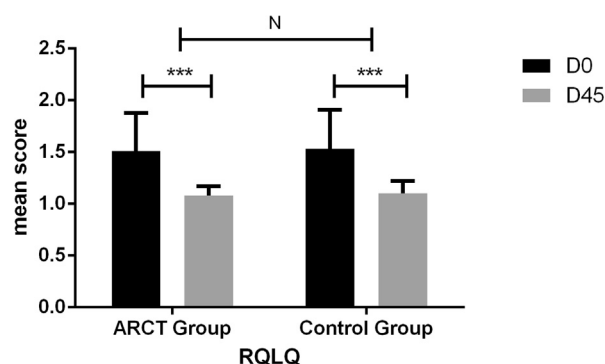


FIGURE 4. RQLQ score in the ARCT and control group (N : $P > .05$, *** $P < .001$). *ARCT*, Allergic Rhinitis Control Test; *RQLQ*, Rhinitis Quality of Life Questionnaire.

medical cost without increasing AR exacerbation risk, is of great advantage and reasonable for both the patients and doctors. Nowadays, several AR control tools such as RCAT, CARAT, and ARCT have been validated to assess the AR control levels. However, only ARCT has been validated in our previous step-up study.⁹ In the ARCT-driven step-down study, we investigated the potential of ARCT in the patients with AR controlled with INS plus antihistamine (step 4) treatment. The step-down strategy was similar to the step-up one. However, more severe patients with AR (ie, those needed systemic corticosteroid to get control) were excluded from our study, as this was a randomized controlled study; it was not possible to randomize the patients into the control group without treatment adjustment (continue oral steroids) for 60 days.

In the study, we found that the AR control rate was similar in the ARCT group and the control group, whereas less medication use and medical cost were found in the ARCT group. The quality of life was significantly improved in both groups. These findings support recent guideline recommendations to consider stepping-down AR medications when AR is controlled. The study also confirmed that the ARCT questionnaire was qualified to be an indicator for the AR stepping-down strategy.

Several factors might have influence on our study. (i) Allergen exposure level, which always has a predominant impact on patient symptoms.¹⁶ The majority of our patients were mono-sensitized to house dust mite; although it was a perennial allergen, the allergen exposure level for individuals was not likely

to be constant during the study period.^{17,18} Indeed, we found that the AR control level in the control group was fluctuating from 100% at D0 to 85.8% at D45, then 86.7% at D60, even with no treatment adjustment, and thus, the variation of the allergen exposure level could be an explanation. Considering that some of the pollen-sensitized patients were enrolled during the pollen season, which might lead to remarkable bias to our study, we removed their data in a sensitivity analysis and recalculated the AR control level in the 2 groups and found no difference. Although the proportion of multisensitized subjects in our study was identical in both groups, the allergen sensitization profile should be taken into account more carefully in future studies. (ii) Comorbidity and residential area variation. Three patients in the ARCT group and 3 in the control group got a cold during the study; 5 patients in the ARCT group and 3 in the control group experienced residential area change during the study, which might have had an impact on the AR control level in different visits. However, these factors were comparable in the 2 groups and unlikely to affect the primary outcome. (iii) The relatively short duration of the study. ARIA suggest step-down when AR symptoms are controlled for 2 to 4 weeks. In this study, all the patients in the ARCT group were stepped down in 2 weeks; however, some patients might need more than 2 weeks of treatment to get well controlled, which might decrease the AR control level in the group. (iv) The stepwise approach was

TABLE II. B-IPQ score in the ARCT and control group

Item*	ARCT			Control		
	D0 (n = 126)	D60 (n = 108)	P	D0 (n = 129)	D60 (n = 120)	P
1	5.89 ± 1.97	3.68 ± 1.43	<.001	5.95 ± 1.92	3.97 ± 1.44	<.001
2	5.92 ± 1.87	3.91 ± 1.26	<.001	6.22 ± 1.94	4.30 ± 1.54	<.001
3	4.31 ± 1.95	7.19 ± 1.49	<.001	4.17 ± 1.76	6.83 ± 1.44	<.001
4	6.48 ± 1.84	7.46 ± 1.34	<.001	6.36 ± 1.95	7.09 ± 1.42	<.001
5	5.80 ± 2.05	2.88 ± 1.37	<.001	6.02 ± 1.82	3.21 ± 1.49	<.001
6	7.79 ± 2.06	5.81 ± 2.39	<.001	7.83 ± 1.85	5.38 ± 2.08	<.001
7	6.38 ± 2.07	5.31 ± 1.94	<.001	6.15 ± 1.86	4.88 ± 1.94	<.001
8	4.73 ± 2.19	2.90 ± 1.24	<.001	4.93 ± 1.85	3.29 ± 1.43	<.001

Quantitative variables: unpaired *t* test.

The score for each item was not statistically significant between the 2 groups at D0 ($P > .05$); while there were differences of item 2 ($P = .039$), item 4 ($P = .045$), and item 8 ($P = .030$) at D60, other item scores showed no difference ($P > .05$).

ARCT, Allergic Rhinitis Control Test; B-IPQ, Brief Illness Perception Questionnaire.

*On a 0-10 numeric visual analog scale auto-questionnaire, patients scored (1) how much does their illness affect their life, (2) how long do they think their illness will continue, (3) how much control do they feel they have over their illness, (4) how much do they think their treatment can help their illness, (5) how much do they experience symptoms from their illness, (6) how concerned are they about their illness, (7) how well do they feel that they understand their illness, (8) how much does their illness affect them emotionally (eg, make them angry, scared, upset, or depressed).

derived from but not fully in accord with updated ARIA. The approach was appropriate for the step-down study design and local practice; however, the difference between the step-down approach and current practice parameter should be addressed.

From the patient's perspective, there are many reasons to step down AR medications. Despite AR medications being generally well tolerated, they can have several adverse effects. These include nasal irritation, epistaxis and potential growth-suppressive effect of INS in children, and sedation caused by antihistamine.¹⁹⁻²¹ In our study, the incidences of medication side effects were very low in both the ARCT group and the control group, less side effects occurred in the ARCT group than in the control group, although no statistical difference was found, and a larger sample size might be needed to elucidate this issue. In general, less medication taken helps to improve the patient's adherence to treatment.²² In this randomized controlled study, both the ARCT group and the control group presented a medium adherence to pharmacotherapy, although the Morisky score in the ARCT group was lower than that in the control group, no statistically significant difference existed between the 2 groups. It should be noted that patient adherence was usually poorer in observational studies compared with controlled studies and diminished over time with treatment.²³ We believed that lower adherence could be found in the real-life AR treatment and the current AR management strategy still had a wide space to be improved (eg, fewer medication categories and lower medicine frequency) to enhance adherence.

Another advantage of step-down treatment for the patients was reduction in the medical cost. AR caused heavy economic burden for both the patients and the society. The annual loss to employers related to untreated AR-related presenteeism has been estimated to be approximately 100 billion Euro in Europe.²⁴ In the United States, the total annual cost of lost productivity attributable to AR was significantly higher than the cost for any other condition assessed including diabetes and coronary heart disease.²⁵ In our study, the ARCT-driven stepping-down strategy significantly reduced direct medical cost, which helped to alleviate the patient and society financial burden. Considering that there were more than 150 million patients in China suffering from AR, the stepping-down strategy is of great value in future health economics studies.²⁶ In addition, most patients prefer to

be involved in management decisions and take the minimum medication necessary to control symptoms. We found a significantly improved B-IPQ score in both ARCT and control groups after a 60-day treatment, whereas the patients in the ARCT group were more confident to the treatment and felt less emotional affection by AR, which suggested that the step-down strategy had a similar or even better positive effect on the patient's perception to AR than maintaining treatment. This was also found to be associated with a rhinitis-related quality-of-life improvement in most patients.

In conclusion, the findings from the comparative effectiveness study suggest that ARCT questionnaire-driven stepping-down pharmacotherapy strategy is associated with similar clinical outcomes at a reduced cost as maintaining the current treatment level. The stepping-down strategy also possesses the advantage of improvement in quality of life and potential less medication side effect and higher adherence to AR treatment. ARCT is an optimal tool for evaluating the step-down eligibility. More studies may be needed to compare the role of ARCT and other AR control questionnaires in the AR stepwise treatment.

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