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Original Article

Efficacy comparison between mometasone furoate combined with azelastine hydrochloride and azelastine hydrochloride alone in treatment of allergic rhinitis with adenoidal hypertrophy in children

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Abstract: Objective: This study aimed to compare efficacy between mometasone furoate combined with azelastine hydrochloride and azelastine hydrochloride alone in the treatment of allergic rhinitis (AR) with adenoidal hypertrophy (AH) in children. Methods: One hundred and fifty-seven children with AR and AH were retrospectively analyzed. Children treated with azelastine hydrochloride nasal spray and mometasone furoate nasal spray were included in group A, while children treated with azelastine hydrochloride nasal spray alone in group B. The two groups of children were compared in terms of total nasal symptom score, vital signs score, Mini Rhinoconjunctivitis Quality of Life Questionnaire (MiniRQLQ) score and clinical efficacy. Results: In groups A and B, the total nasal symptom, vital signs and MiniRQLQ scores at 2 weeks after treatment were lower than those before treatment (all $P < 0.05$). The three scores in group A were better than those in group B (all $P < 0.05$). Conclusion: In conclusion, mometasone furoate combined with azelastine hydrochloride was more effective than mometasone furoate nasal spray alone in the treatment of children with AR and AH, worthy of clinical promotion.

Keywords: Azelastine hydrochloride nasal spray, mometasone furoate nasal spray, combined application, allergic rhinitis with adenoid hypertrophy in children, efficacy comparison

Introduction

Allergic rhinitis (AR) is an allergic inflammation of the nose and has perennially or seasonally attacks [1, 2]. As a result of environmental pollution and changes in living habits in recent years, its incidence rate in children is getting higher and higher [3, 4]. Adenoidal hypertrophy (AH), which has many causes, is common in children but not very harmful to their life [5]. Although the causes of AH are numerous, clinical studies confirm that AR is the main cause of AH, a complication of AR, and the two diseases are easy to affect each other [6, 7]. According to a report, inflammatory stimulation caused by AR leads to hyperplasia and hypertrophy of adenoids, and affects children's growth and development [8].

Regarding the clinical treatment of children with AR and AH, ear, nose, and throat physicians consider that AR should be treated by intranasal corticosteroids [9]. The efficacy of intranasal corticosteroids is close to systemic corticosteroids, but the side effects are far lower [10]. According to clinical treatment of AR, intranasal corticosteroids combined with antihistamines are effective for treatment of AR, AR with AH and other non-allergic nasal inflammation [11, 12]. Corticosteroid is a double-edged sword. It is necessary to control medication time and to select their appropriate age group and use them correctly. Moreover, children are in their developmental stages, so drug safety is essential [13]. The clinical efficacy and safety of nasal drugs such as mometasone furoate and azelastine hydrochloride for adults with AR have been verified [14, 15], but the efficacy and safety for children remain unclear. In this study, efficacy comparison between mometasone furoate combined with azelastine hydrochloride and azelastine hydrochloride alone in the treatment of AR with AH in children was performed to ana-

lyze the therapeutic effect of correct use of intranasal corticosteroids on the children.

Materials and methods

General information

A total of 157 children with AR and AH who were admitted to the First People's Hospital of Wenling from January 2016 to December 2017 were retrospectively analyzed. Children who were treated with azelastine hydrochloride nasal spray in the evening and mometasone furoate nasal spray in the morning were included in group A, while children who were treated with azelastine hydrochloride nasal spray alone in group B. Inclusion criteria: Children aged 1-9 years old and diagnosed with AR and AH based on the diagnostic criteria for AR with AH adopted by the World Health Organization [16]. Exclusion criteria: Children with cognitive, movement and language disorders; children who were allergic to azelastine hydrochloride and mometasone furoate; children with liver, coagulation and renal dysfunction or other infectious diseases. Before the study, children and their families were informed and signed an informed consent form. The study was approved by the Ethics Committee of the First People's Hospital of Wenling.

Administration methods

Children in group A were sprayed with azelastine hydrochloride nasal spray (10 mL: 10 mg) (Guizhou Yunfeng Medicine Industry Co., Ltd.) twice every morning and night (4 times every day). In addition, they were sprayed with mometasone furoate nasal spray (50 μg * 60) (Zhejiang Xianju Pharmaceutical Co., Ltd.) once every morning.

Children in group B were sprayed with azelastine hydrochloride nasal spray (10 mL: 10 mg) (Guizhou Yunfeng Medicine Industry Co., Ltd.) twice (0.56 mg) every morning and night (4 times every day).

Evaluation of total nasal symptoms and vital signs

Children's total nasal symptoms (rhinocnesmus, rhinocleisis, nasal discharge and sneezing) were evaluated, and the Visual Analogue Scale (VAS) [17] was used to obtain the total score of these symptoms. The VAS score (total nasal symptom score) before, at 1 and 2 weeks after treatment was compared between groups A and B. According to Diagnostic Criteria and Efficacy Evaluation Criteria of Allergic Rhinitis with Adenoid Hypertrophy [18], children's vital signs were evaluated by relevant attending doctors at the time of regular return visits. The vital signs scores before, at 1 and 2 weeks after treatment was compared between groups A and B.

Evaluation of quality of life

Children's quality of life was evaluated the through Mini Rhinoconjunctivitis Quality of Life Questionnaire (MiniRQLQ) [19], including nasal, eye and other symptoms (each symptom item was scored separately). The higher the score was, the worse the improvement of quality of life was. The quality of life before, at 1 and 2 weeks after treatment was compared between groups A and B.

Efficacy evaluation criteria

Evaluation criteria for AR were as follows: markedly effective: AR-related clinical symptoms disappeared. Effective: The symptoms were significantly relieved. Invalid: The symptoms were not relieved. Evaluation criteria for AH were as follows: markedly effective: nasopharynx CT showed normal AH and symptoms of respiratory-related sleep disorders disappeared. Effective: Nasopharynx CT showed that AH was reduced by more than 50% and the symptoms were significantly relieved. Invalid: Nasopharynx CT showed that AH was unchanged before and after treatment, and the symptoms were not relieved.

Evaluation of adenoid thickness/nasopharyngeal cavity width (A/N)

The adenoid thickness (A) and nasopharyngeal cavity width (N) of children were obtained through CT. Small A/N ratio indicated that the symptoms of AH were relieved. The respiratory-related sleep disorder symptom score and A/N before, at 1 and 2 weeks after treatment were compared between groups A and B.

Statistical methods

SPSS19.0 (Bizinsight (Beijing) Information Technology Co., Ltd.) software system was used for statistical analysis. Count data are express-

Table 1. General information

Groups	Group A (n = 83)	Group B (n = 74)	t/χ^2	P
Age (year)	6.0 ± 3.1	6.0 ± 2.0	0.024	0.981
Gender			0.003	0.955
Male	43 (51.81)	38 (51.35)		
Female	40 (48.19)	36 (48.65)		
Course of disease (year)	2.45 ± 0.48	2.39 ± 0.37	0.869	0.386
Seasonal allergies			0.331	0.565
Yes	63 (75.90)	59 (79.73)		
No	20 (24.10)	15 (20.27)		
Living condition			0.071	0.789
City	51 (61.45)	47 (63.51)		
Suburb	32 (38.55)	27 (36.49)		
Familial inheritance			0.185	0.667
Yes	18 (21.69)	14 (18.92)		
No	65 (78.31)	60 (81.08)		

Table 2. Efficacy on AR

Groups	Markedly effective	Effective	Invalid	Total effective
Group A (n = 83)	42 (50.60)	39 (46.99)	2 (2.41)	81 (97.59)
Group B (n = 74)	30 (40.54)	21 (28.38)	23 (31.08)	51 (68.92)
χ^2				24.020
P				< 0.001

Note: AR, allergic rhinitis.

Table 3. Efficacy on AH

Groups	Markedly effective	Effective	Invalid	Total effective
Group A (n = 83)	41 (49.40)	40 (48.19)	2 (2.41)	81 (97.59)
Group B (n = 74)	30 (40.54)	20 (27.03)	24 (32.43)	50 (67.57)
χ^2				5.520
P				< 0.001

Note: AH, Adenoidal hypertrophy.

ed by n (%) and tested by χ^2. Measurement data are expressed by ($\overline{x}$ ± sd). Comparison between two groups was tested by t, while comparison between multiple groups by two-way repeated measures ANOVA. P < 0.05 indicates a statistically significant difference.

Results

General information

There was no statistically significant difference in general information between groups A and B (P > 0.05), which were comparable. More details are shown in **Table 1**.

Efficacy

Efficacy on AR: For the treatment of AR, 42 cases were markedly effective, 39 were effective and 2 were invalid in group A; 30 were markedly effective, 21 were effective and 23 were invalid in group B. The total effective cases in group A were significantly more than those in group B (P < 0.001). More details are shown in **Table 2**.

Efficacy on AH: For the treatment of AH, 41 cases were markedly effective, 40 were effective and 2 were invalid in group A; 30 were markedly effective, 20 were effective and 24 were invalid in group B. The total effective cases in group A were significantly more than those in group B (P < 0.001). More details are shown in **Table 3**.

Vital signs and total nasal symptoms scores before and after treatment

Vital signs score before and after treatment: In groups A and B, the vital signs scores before treatment were lower than that at 2 weeks after treatment, whereas there was no statistically significant difference between before and at 1 week after treatment (P > 0.05); the differences between at 2 weeks after treatment and before and at 1 week after treatment were statistically significant (P < 0.001). Before and at 1 week after treatment, there was no statistically significant difference in the score between groups A and B (P > 0.05). At 2 weeks after treatment, the score in group A was significantly lower than that in group B (P < 0.05). More details are shown in **Table 4**.

Total nasal symptom score before and after treatment: In groups A and B, the total nasal symptom scores before treatment was lower than that at 2 weeks after treatment, whereas there was no statistically significant difference between before and at 1 week after treatment (P > 0.05); the differences between at 2 weeks after treatment and before and at 1 week after treatment were statistically significant (P < 0.001). Before and at 1 week after treatment,

Table 4. Vital signs score before and after treatment

Groups	Group A (n = 83)	Group B (n = 74)	t	P
Before treatment	2.41 ± 0.56	2.32 ± 0.46	1.092	0.276
One week after treatment	2.31 ± 0.44	2.30 ± 0.45	0.141	0.888
Two weeks after treatment	0.79 ± 0.35	0.98 ± 0.41	3.132	< 0.05
F	325.900	224.900		
P	< 0.001	< 0.001		

Table 5. Total nasal symptom score before and after treatment

Groups	Group A (n = 83)	Group B (n = 74)	t	P
Before treatment	7.62 ± 1.88	7.68 ± 1.71	0.835	0.208
One week after treatment	6.98 ± 1.65	7.01 ± 1.49	0.905	0.119
Two weeks after treatment	3.63 ± 1.22	5.45 ± 1.26	9.188	< 0.001
F	147.600	43.180		
P	< 0.001	< 0.001		

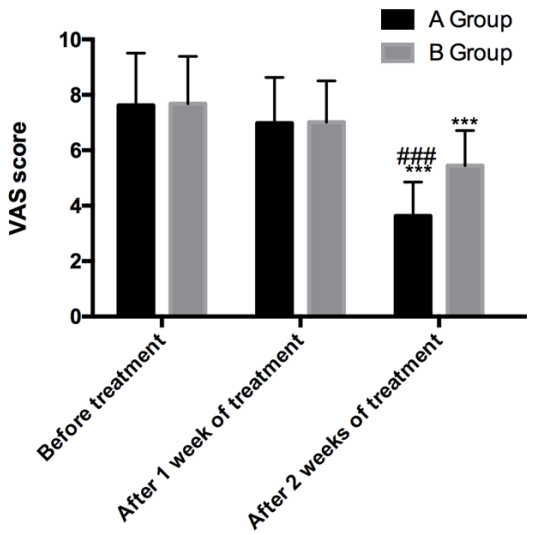

Figure 1. Total nasal symptom score before and after treatment. Compared with before and at 1 week after treatment in group, ***P < 0.001; compared with group B, ###P < 0.001. VAS: Visual Analogue Scale.

there was no statistically significant difference in the score between groups A and B (P > 0.05). At 2 weeks after treatment, the score in group A was significantly lower than that in group B (P < 0.001). More details are shown in **Table 5** and **Figure 1**.

Quality of life score (nasal, eye and other symptom scores) before and after treatment

In groups A and B, the nasal, eye and other symptom scores before treatment were lower than those at 2 weeks after treatment, whereas there was no statistically significant difference between before and at 1 week after treatment (P > 0.05); the differences between at 2 weeks after treatment and before and at 1 week after treatment were statistically significant (P < 0.001). Before and at 1 week after treatment, there was no statistically significant difference in the scores between groups A and B (P > 0.05). At 2 weeks after treatment, the scores in group A were significantly lower than those in group B (P < 0.001). More details are shown in **Table 6**.

A/N before and after treatment

In groups A and B, the A/N before treatment was lower than that at 2 weeks after treatment, whereas there was no statistically significant difference between before and at 1 week after treatment (P > 0.05); the difference between at 2 weeks after treatment and before and at 1 week after treatment was statistically significant (P < 0.001). Before and at 1 week after treatment, there was no statistically significant difference in the A/N between groups A and B (P > 0.05). At 2 weeks after treatment, the A/N in group A was significantly lower than that in group B (P < 0.001). More details are shown in **Table 7**.

Discussion

Most parents who are cautious about their children's medication, especially medication of corticosteroids, lack correct cognition about intranasal corticosteroids. Some parents, even with the guidance of professional doctors, still think that the side effects of corticosteroids greatly affect children, so medication is discontinued upon the improvement of AR or they refuse to use nasal sprays containing corticosteroids at the beginning [20]. In order to correct their misconceptions, reports on intranasal corticosteroids confirm that nasal sprays containing corticosteroids are locally used for children and different from glucocorticoids injected into or orally taken by adults [21]. The dosage of intranasal corticosteroids used for children is less than systemic medication. A

Table 6. Quality of life score before and after treatment

Groups	Before treatment	One week after treatment	Two weeks after treatment	F	P
Nasal symptom					
Group A (n = 83)	3.68 ± 0.99	3.56 ± 0.79	1.18 ± 0.33	289.000	< 0.001
Group B (n = 74)	3.78 ± 0.78	3.67 ± 0.75	1.74 ± 0.63	186.400	< 0.001
Eye symptoms					
Group A (n = 83)	1.58 ± 0.32	1.54 ± 0.22	0.49 ± 0.25	446.000	< 0.001
Group B (n = 74)	1.57 ± 0.65	1.55 ± 0.46	0.78 ± 0.61	44.770	< 0.001
Other symptoms					
Group A (n = 83)	1.68 ± 0.99	1.65 ± 0.58	0.70 ± 0.54	48.100	< 0.001
Group B (n = 74)	1.65 ± 0.93	1.63 ± 0.74	0.92 ± 0.59	21.800	< 0.001

Table 7. A/N before and after treatment

Groups	Group A (n = 83)	Group B (n = 74)	t	P
Before treatment	0.71 ± 0.09	0.72 ± 0.01	0.950	0.344
One week after treatment	0.70 ± 0.05	0.71 ± 0.06	1.139	0.257
Two weeks after treatment	0.49 ± 0.02	0.67 ± 0.04	36.240	< 0.001
F	349.400	29.320		
P	< 0.001	< 0.001		

Note: A, adenoid thickness; N, nasopharyngeal cavity width.

study shows that intranasal corticosteroids at recommended dosage have no effect on children's growth, so they are very safe [22]. Proper use of nasal sprays not only directly affects their efficacy, but also greatly reduces their side effects [23].

In this study, children who were treated with azelastine hydrochloride nasal spray in the evening and mometasone furoate nasal spray in the morning were included in group A, while children who were treated with azelastine hydrochloride nasal spray alone in group B. The two groups of children were compared in terms of total nasal symptom score, vital signs score, quality of life and clinical efficacy. The total effective cases of AR with AH in group A were significantly more than those in group B. Azelastine hydrochloride nasal spray can significantly relieve allergic symptoms of patients with rhinitis [24]. Mometasone furoate nasal spray as the third generation of intranasal corticosteroids has a stronger effect like local hormones [25]. According to studies, azelastine hydrochloride combined with mometasone furoate, which is more effective than azelastine hydrochloride or mometasone furoate-related intranasal corticosteroids alone in the treatment of rhinitis, has an antihistaminic effect and relieves inflammatory and allergic reactions of the nose and adenoids [26]. Therefore, azelastine hydrochloride combined with mometasone furoate has a better therapeutic effect on AR with AH in children. In groups A and B, the vital signs and total nasal symptom scores before treatment were lower than those at 2 weeks after treatment, whereas there was no statistically significant difference between before and at 1 week after treatment; the differences between at 2 weeks after treatment and before and at 1 week after treatment were statistically significant; at 2 weeks after treatment, the scores in group A were significantly lower than those in group B. Therefore, azelastine hydrochloride combined with mometasone furoate is more effective than azelastine hydrochloride nasal spray alone in improving the nasal allergy and inflammation of children with AR and AH. In similar research on intranasal corticosteroids, mometasone furoate nasal spray in the morning combined with azelastine hydrochloride nasal spray in the evening is more effective and safer in improving nasal and vital sign symptoms of patients with AR or AH [27]. In groups A and B, the quality of life score and A/N at 1 week after treatment were lower than those before treatment, and those at 2 weeks after treatment were significantly lower than those at 1 week after treatment; the scores in group A were significantly lower than those in group B. The combination of mometasone furoate (an intranasal corticosteroid) and azelastine hydrochloride (an antihistamine) is safe and effective for the treatment of AR [28], indicating that moderate intranasal corticosteroids combined with antihistamines directly act on target organs through intranasal administration, which significantly improves the quality of

life of children with AR and AH and relieves their adenoidal and nasopharyngeal cavity hypertrophy [29, 30].

In this study, subjects are few and big data statistics could not be obtained, which may lead to contingency in the results and deviation in the result analysis. Therefore, the subjects will be increased to enrich this study in the later period.

In conclusion, azelastine hydrochloride nasal spray combined with mometasone furoate nasal spray at proper dosage and medication time is more effective than azelastine hydrochloride nasal spray alone in the treatment of children with AR and AH, worthy of clinical promotion.

Disclosure of conflict of interest

None.

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