



ISSN (E): 2277- 7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.03  
TPI 2019; 8(4): 168-171  
© 2019 TPI  
www.thepharmajournal.com  
Received: 15-02-2019  
Accepted: 19-03-2019

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## Effectiveness of the use of ivy medicine in the treatment of children with exacerbation of recurrent bronchitis

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### Abstract

In the treatment of bronchitis in children, the safety of medicinal therapy is very important; in connection with this the herbal preparations are widely used. The article represents the results of the study of the effectiveness of ivy medicines in the treatment of children with recurrent bronchitis.

**Objective of the work:** To study the clinical and phonospirographic efficiency of the use of the herbal medicine ivy syrup in the complex therapy of children.

**Material and methods:** There were examined 40 children aged from 3 to 16 years, who received ivy syrup in the treatment complex. The state of patients according to the main clinical signs of bronchitis was assessed during the first (1<sup>st</sup> day), the second (3<sup>rd</sup>-4<sup>th</sup> day), the third (7<sup>th</sup>-8<sup>th</sup> day) and, if necessary, the fourth (10<sup>th</sup>-12<sup>th</sup> days of observation) visits. During each visit, there were performed: a clinical examination of patients, a phonospirographic examination and a comprehensive assessment of the treatment applied.

**Results:** The clinical picture in most of the examined persons was represented by a cough, which at the beginning of the disease most often had a dry, obsessional character, in the dynamics became more productive, and gradually it disappeared. By auscultation, at the beginning of the disease, the harsh breathing with prolonged expiration, scattered bilateral dry wheezing murmurs in different parts of the lungs were heard; they changed their intensity and localization in the forced breathing and coughing. In the dynamics, there were sibilant wheezes, productive minor-, moderate-and large bubbling rales. The analysis of phonospirograms obtained during the dynamic observation showed that the duration of the respiratory cycle in patients with bronchitis during the 1<sup>st</sup> visit was significantly reduced. In this case, respiratory pauses in patients with bronchitis have also decreased. In the study of frequency indices, the expansion of their range in the ill children was revealed. The analysis of the intensity of inspiration and expiration in children with bronchitis showed an increase of the indices on all channels compared with the healthy ones. In the dynamics, the intensity of breathing in and breathing out decreased with normalization during the 3<sup>rd</sup> visit. In 92.5% of patients with bronchitis, during the first visit, additional respiratory murmurs were registered. Thus, in 72.5% of patients, dry rales were noted. In 35.0% of children in the phase of inspiration and expiration, there were moist rales. Against the background of treatment, there was an improvement of the general condition of patients during the 2<sup>nd</sup> visit (3<sup>rd</sup>-4<sup>th</sup> day of treatment): manifestations of intoxication decreased, sputum release was facilitated, pulmonary rales regressed.

**Conclusions:** Application in the complex of the treatment of recurrent bronchitis of the herbal preparation of ivy syrup was accompanied by an effective coughing regression and optimization of the phonospirographic picture, which allows recommending its wider use in the treatment of children with an exacerbation of this disease.

**Keywords:** Ivy medicine, treatment of children, recurrent bronchitis

### Introduction

Diseases of the respiratory organs are often found in children and play a significant role in the structure of general morbidity. Over the past ten years, the number of diseases of the bronchopulmonary system, mainly due to inflammatory processes of the upper and lower respiratory tract, increased 3.6-fold among children <sup>[1]</sup>. Today, the bronchopulmonary pathology sick rate among the children varies from 15 to 50%. This percentage increases significantly (up to 50-90%) in children who are often ill with acute respiratory infections, especially in environmentally unfriendly regions <sup>[3, 7]</sup>. Moreover, a significant medical problem is the ambiguity of the prognosis in recurrent bronchitis in children. Thus, the recovery is observed only in 75.0-80.0% of cases, while in the rest of patients the disease is transformed into chronic bronchitis or bronchial asthma <sup>[2]</sup>.

In the treatment of bronchitis in children, the safety of medicinal therapy is very important; in connection with this the herbal preparations are widely used.

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In addition, the particular topicality of the use of phytopreparations at the stages of restorative treatment of patients with recurrent bronchitis should be noted, because of the possibility of the use of these agents for a long time, both to prevent the occurrence of recurrence, and in the complex treatment in case of exacerbation of the disease [6].

An ivy leaves extract is very popular in many European countries for the treatment of common cold accompanied by cough. The main active ingredients that determine its effectiveness in the treatment of cough include saponins ( $\alpha$ -hederin, hederagenin, hederosaponin C (hederakozid C), hederacolchisides) which are capable of removing respiratory spasm due to the influence on  $\beta_2$ -adrenergic receptors, as well as flavonoids (kaempferol, quercetin) [4, 5, 10]. The secretolytic orientation of the ivy leaves extract is realized due to activation of protein kinase A, as well as the participation of surfactant in the synthesis, which contributes to sputum dilution by influencing its gel phase. In addition, saponins contained in the leaves of ivy, interact with gastric mucosal receptors, stimulating coughing through the reflex effect on the vagus nerve (gastropulmonary mucokinetic reflex [8]). The antimicrobial activity of ivy leaves saponins has also been experimentally proved as for microorganisms such as *Staphylococcus aureus*, *Streptococcus mutans*, *Salmonella para A*, *Shigella flexneri*, *Bacillus anthracis*, as well as *Candida albicans*, *Microsporum*, etc. [8] The results of experimental studies have confirmed that hederosaponin-C, hederacolchisides E and F have weak anti-inflammatory

activity, less pronounced in the first phase of the inflammatory process and more pronounced in the second one, which is probably due to their ability to inhibit the activity of inflammatory mediators, in particular bradykinin, and also to influence the synthesis of prostaglandins [9]. Saponins of the ivy leaves also have expressed antioxidant properties, which are comparable to those of  $\alpha$ -tocopherol, as demonstrated by the results of *in vitro* experiments [10].

**Objective:** To study the clinical and phonospirographic efficiency of the use of herbal preparation of ivy syrup in the complex therapy of children of different age with the exacerbation of recurrent bronchitis.

**Material and methods**

There were examined 40 children aged from 3 to 16 years (average age (8.1±1.4) years) who received the ivy syrup medicine in the complex of treatment.

The state of patients according to the main clinical signs of bronchitis was assessed during the first (day 1), the second (days3-4), the third (days7-8) and, if necessary, the fourth (10-12 days of observation) visits. In each visit, a clinical examination of patients was performed, a phonospirographic examination and a comprehensive assessment of the treatment applied.

Expression of manifestations of bronchitis in children was evaluated according to the scoring system (Table 1).

**Table 1:** Evaluation of clinical symptoms in children with recurrent bronchitis (points)

Number of points	Clinical symptom				
	Body temperature (axillary)	Intensity of cough	Sputum discharge (cough productivity)	Dyspnea	Pulmonary rales
0 points	normal	absent	without effort	absent	absent
1 point	Subfebrile (37.1-38.0°C)	minor	with minimal effort	minor	very few
2 points	febrile (38.1-39.0°C)	moderate	with little effort	moderate	moderate amount
3 points	high febrile (39.1-41.0°C)	strong	with considerable effort	expressed	a significant amount

Computed phonospirography (CPSG) was performed at the phonospirographic complex “Kora-03M1”, followed by its visualization in the form of respirograms. Registration of breathing sounds was performed simultaneously in four points on the surface of the chest: at the level of the 2<sup>nd</sup> intercostal space along the midclavicular line to the right and left – “1k” and “4k”, at the level of the 7<sup>th</sup> intercostal space at the angle of the shoulder blade to the right and left – “2k” and “3k”. On the basis of the received phonospirograms, the following parameters of respiratory murmurs were measured: duration (c) of the respiratory cycle; the frequency range (Hz) and the intensity (dB) of the inspiration and expiration, as well as the presence of additional spectral components (additional respiratory murmurs).

In order to determine the phonospirographic criteria for bronchitis, a comparative analysis of phonospirograms of all children with bronchitis and patients of the control group (20 practically healthy children of the same age with patients) was performed.

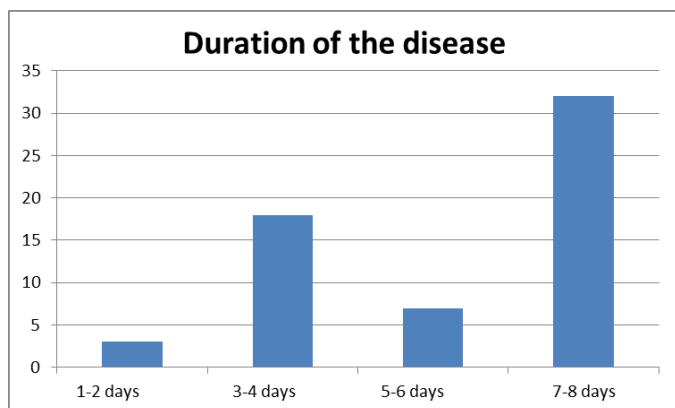
Statistical data processing was performed using the Statistica 5.5A software package (StatSoft, USA). Average values were given in the form of (M±m), where M – is the mean value of the index, m – is the standard error of the mean value. When comparing the mean values, Student’s criterion was used. The results were considered statistically significant at values  $p<0.05$ .

**Research results and their discussion**

The analysis of anamnestic data showed that 12 patients out of the examined children (30.0%) had acute respiratory disease (ARD) no more than 3 times, 27 (67.5%) – 4-6 times and only 1 child (2.5%) – 7 times during the last year.

It was determined that in the actual episode of the disease, the vast majority of patients – 22 (55.0%) applied for medical assistance with the duration of the main manifestations of the disease for about 7-8 days. And the clinic of bronchitis at the time of the first treatment was observed in 15 (37.5%) children within 3-4 days, and in 21 (52.5%) patients – within 5-6 days (Fig. 1).

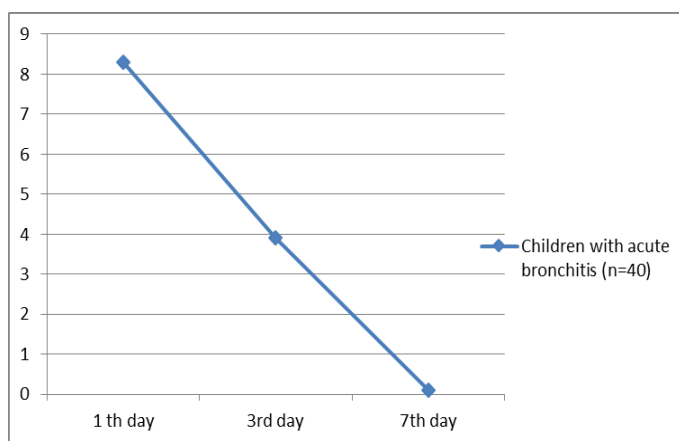
The performed study showed that the clinical picture in most of the examined persons was represented by cough, which at the beginning of the disease most often had a dry, obsessional character, in the dynamics (from the 3<sup>rd</sup>-6<sup>th</sup> day) became more productive, and gradually (up to 7<sup>th</sup>-10<sup>th</sup> day) it disappeared. During the examination of the children with recurrent bronchitis, as a rule, there were no signs of respiratory failure and severe symptoms of intoxication. In palpation and percussion, the changes in the lungs were usually absent.



**Fig 1:** Duration of the disease at the time of the first visit to a doctor in children with recurrent bronchitis.

By auscultation, at the beginning of the disease, the harsh breathing with prolonged expiration, scattered bilateral dry wheezing murmurs in different parts of the lungs were heard; they changed their intensity and localization in the forced breathing and coughing. In the dynamics, there were sibilant wheezes, productive minor-, moderate-, and large bubbling rales.

Taking into account the nature of cough, as the main symptom of the disease, which at first had a dry, sometimes debilitating nature, and in the dynamics became more productive, it was reasonable to prescribe the expectorants on the basis of an ivy extract, possessing powerful secretolytic and bronchodilatory properties. Against the background of the treatment, there was an improvement in the general condition of patients at the time of the 2<sup>nd</sup> visit (during the 3<sup>rd</sup>-4<sup>th</sup> day of treatment): the manifestations of intoxication decreased (temperature, general weakness decreased or disappeared, appetite increased), sputum discharge improved, murmurs in the lungs regressed. The overall activity of the disease in the dynamics from the first to the second visit decreased from (8.3±1.2) points to (3.9±0.7) points ( $p<0.05$ ). Further, the reduction of the main manifestations of the disease was noted due to the normalization of body temperature, reduction of auscultative changes in the lungs, changes in the nature (it became more productive) and regression of cough intensity. Thus, the total activity of the disease in the third visit (7<sup>th</sup>-8<sup>th</sup> day) was (0.4±0.02) points, having become more likely to be lower than during the first and second visits ( $p<0.05$ ) (Fig. 2).



**Fig 2:** Dynamics of the main manifestations of the disease (in points) in children with recurrent bronchitis under the influence of treatment

Besides, the cough dynamics was rather representative, as the main symptom of the disease, during the observation and application of the herbal ivy syrup medicine. Thus, in most of the examined persons the number of night cough attacks, its intensity, frequency of appearance decreased by the 2<sup>nd</sup> visit (the 3<sup>rd</sup>-4<sup>th</sup> day of the treatment). As part of this visit, a significant part of patients (36 (90.0%)) cough became more productive. Significant decrease in the intensity of cough was observed until the 3<sup>rd</sup> visit (the 7<sup>th</sup>-8<sup>th</sup> day of observation). Moreover, complaints of cough during the 3<sup>rd</sup> visit were submitted only by 18 (45.0%) of the examined persons. At the final stage of observation (the 10<sup>th</sup>-14<sup>th</sup> day), cough, as the main symptom, continued only in 3 (7.5%) patients. Accordingly, 37 children (92.5%) did not have cough or other signs of the disease.

The analysis of phonospirograms obtained during the dynamic observation showed that the duration of the respiratory cycle in patients with bronchitis during the 1<sup>st</sup> visit was significantly reduced (tachypnoea), amounting 0.73±0.03 s against 0.96±0.07 s in healthy persons ( $p<0.05$ ) during inspiration and 0.98±0.03 s against 1.17±0.05 s, respectively, during expiration ( $p<0.05$ ). In this case, respiratory pauses in patients with bronchitis also decreased: 0.98±0.05 s versus 1.18±0.07 s in the control group. Such a change in some phases of respiration led to a reduction of the total duration of the respiratory cycle to 2.68±0.09 s against 3.31±0.13 s in healthy persons ( $p<0.05$ ).

When comparing the obtained results of the frequency range of inspiration and expiration in the group of patients with recurrent bronchitis with indices in healthy persons, the expansion of their frequency range up to 909-989 Hz in the breathing in and up to 695-750 Hz in the breathing out, against 675-746 Hz and 503-573 Hz, respectively, in the control group.

Analyzing the intensity (dB) of inspiration and expiration in children with bronchitis during the 1<sup>st</sup> visit, the increase of their indices on all channels was noted in comparison with healthy ones ( $p<0.05$ ). In dynamics, the intensity of breathing in and breathing out decreased with normalization during the 3<sup>rd</sup> visit (7<sup>th</sup>-8<sup>th</sup> day).

In 37 (92.5%) patients with bronchitis, within the 1<sup>st</sup> visit, additional respiratory sounds (murmurs) were registered. Thus, in 29 (72.5%) patients, unstable long-term (0.4-0.6 s) spectral changes were observed at levels from 200 to 500 Hz, with an intensity from 48 to 38 dB (dry rales). Short-term (up to 0.1 s), inconstant high-intensity (from 50 to 40 dB), broadband impulse spectral changes with frequency range from 150 to 1300 Hz (moist rales) were recorded in 14 (35.0%) children in the inspiration and expiration phase. It should be noted that the data of PSG-picture (phonospirography) clearly objectified the auscultatory changes obtained during routine examination, fully correlating with them.

During the 2<sup>nd</sup> visit (the 3<sup>rd</sup>-4<sup>th</sup> day), under the influence of ivy syrup action, the dynamics of additional respiratory sounds (murmurs) was observed in the form of regression of dry and the appearance of a greater number of moist (mostly minor and moderate bubbling sibilant wheezes) rales.

During the 3<sup>rd</sup> visit (the 7<sup>th</sup>-8<sup>th</sup> days), the disappearance of rales was observed in most patients, and in 36 (90.0%) children no additional respiratory sounds were recorded (Table 2)

**Table 2:** Phonospirography data in children with recurrent bronchitis (n=40) in the monitoring dynamics under the influence of treatment

Characteristics of rales	Frequency range	1 <sup>st</sup> day	3 <sup>rd</sup> -5 <sup>th</sup> day	7 <sup>th</sup> -8 <sup>th</sup> day
Dry rales				
Wheezing	180-710 Hz	24 (60.0)	3* (7.5)	-
Mono wheeze	180-355 Hz	3 (7.5)	-	-
Buzzing	355-710 Hz	-	-	-
Moist rales:				
minor bubbling rales:				
Sibilant wheezes	180-355 Hz	21 (52.5)	8* (20.0)	1 (2.5)
Sonorous rales	710-1400 Hz	-	-	-
moderate bubbling rales:				
Sibilant wheezes	180-355 Hz	20 (50.0)	26* (65.0)	5 (12.5)
Sonorous rales	355-710 Hz	-	-	-
large bubbling rales:				
Sonorous rales	180-355 Hz	1 (2.5)	1 (2.5)	-
Notes:	1. All data is given in absolute numbers 2. The percentage of persons with the indicated sign to the total number of patients in the group is represented in the brackets 3. Probability of difference $P < 0.05$			

Thus, the obtained data on the effectiveness of the medicine ivy syrup confirm its expediency when used in children with an exacerbation of recurrent bronchitis in order to optimize the course of the disease and facilitate the discharge of sputum. Quickly enough (during the 3<sup>rd</sup>-4<sup>th</sup> day of the disease) dry cough in children with bronchitis passed into a productive one and was subjected to the significant regress (or even disappeared) up to the 7<sup>th</sup>-8<sup>th</sup> day. Such positive clinical dynamics was accompanied by an optimization of the auscultative picture, the transition of dry rales to moist ones with gradual (up to the 7<sup>th</sup>-10<sup>th</sup> day of treatment) disappearance. It is the evaluation of the clinical effect of the medicine ivy syrup allowed us to recommend every child with exacerbation of recurrent bronchitis ten-day treatment. Such a course of therapy is a guarantee of preventing the development of complications and accelerating the recovery of the child. It should also be noted that, when using the ivy syrup medicine, there were no side effects or any other undesirable effects that could have been associated with the administration of the medicine. The obtained data allow us to recommend herbal medicinal products, in particular those containing an ivy extract in wider use in the treatment of children with exacerbation of recurrent bronchitis.

### Conclusions

1. Characteristic phonospirographic changes in children with recurrent bronchitis in the stage of exacerbation are: an increase in the frequency range during inspiration and expiration, increasing their intensity; the presence of additional spectral changes in the form of dry and moist rales.
2. Use of the herbal medicine ivy syrup in the complex of treatment of recurrent bronchitis was accompanied by an effective coughing regress and optimization of the phonospirographic picture, which allows it to be recommended for the use in this category of patients.

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