

**PROTECTIVE ACTION OF POLARIZED POLYCHROMATIC LIGHT IN CASE OF FLU AND ACUTE RESPIRATORY INFECTIONS.
REPORT I. EFFICACY OF POLARIZED LIGHT IN TREATMENT OF MICE INFECTED WITH A/PR/8/34 (H1N1) FLU VIRUS**

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Abstract

During pandemic coronavirus disease (COVID-19) a number of problems emerged concerning specific diagnostics and possible development of etiotropic and pathogenic treatment. At the same time, common etiopathogenic mechanisms are known to have a special place in occurrence and development of acute respiratory diseases.

The studies carried out in the Laboratory of Experimental and Clinical Pathology, the state enterprise “Ukrainian Scientific-Research Institute of Transport Medicine, the Ministry of Health of Ukraine” (V.P. Divocha, 1989-2012), are indicative of that the character of interaction between flu virus and the human body much depends on the state of proteinase-inhibitor body system, playing a considerable role in damaging respiratory tract tissues and development of inflammations. It gives grounds to suppose that effect produced on the proteinase-inhibitor system can be an important way of pathogenic therapy of the disease, and inductors of inhibitor synthesis can be used for prevention and treatment of flu by means of modulation of the human protective mechanisms (1-6).

The paper deals with an alternative pathogenic approach to prevention and treatment of flu and acute respiratory viral infections (ARVI) based on the application of polarized, polychromatic, linear, incoherent, low-energy light (PILER-light) (Guliar S.O., Lymanskyi Yu.P., 2003), which does not contain ultraviolet and a considerable amount of infrared rays (7-12).

Keywords: *pandemic, coronavirus, flu, acute respiratory viral infections (ARVI), PILER-light, proteinase-inhibitor system*

Introduction

During pandemic coronavirus disease (COVID-19) a number of problems emerged concerning specific diagnostics and possible development of etiologic and pathogenic treatment. At the same time, common etiopathogenic mechanisms are known to have a special place in occurrence and development of acute respiratory diseases.

The studies carried out in the Laboratory of Experimental and Clinical Pathology, the state enterprise "Ukrainian Scientific-Research Institute of Transport Medicine, the Ministry of Health of Ukraine" (V.P. Divocha, 1989-2012), are indicative of that the character of interaction between flu virus and the human body much depends on the state of proteinase-inhibitor body system, playing a considerable role in damaging respiratory tract tissues and development of inflammations. It gives grounds to suppose that effect produced on the proteinase-inhibitor system can be an important way of pathogenic therapy of the disease, and inductors of inhibitor synthesis can be used for prevention and treatment of flu by means of modulation of the human protective mechanisms (1-7)

The paper deals with an alternative pathogenic approach to prevention and treatment of flu and acute respiratory viral infections (ARVI) based on the application of polarized, polychromatic, linear, incoherent, low-energy light (PILER-light), which does not contain ultraviolet and a considerable amount of infrared rays (8-12)

In addition to specific prevention of flu and ARVI (vaccination) other nonspecific methods of prevention of these diseases have become of great importance including: strengthening of the immune system, increase of the body protective ability when polarized polychromatic incoherent light (PILER-light) produces an effect on it in addition to pharmacological therapy. Specific methods are associated with immunity stimulation and are directed to antiviral action, especially during pre-epidemic period. Today a complete failure is evidenced in the struggle against flu by means of the methods producing a specific action on experimental flu infection simulated even in the mildest form on animals prone to this infection. Till nowadays specific pharmacological agents producing effect on flu viral infection similar to that

of sulfonamides or penicillin in case of bacterial diseases have not been found yet (13-17).

Objective of the work was to study changes of the protease-inhibitor system occurring under the action of polarized polychromatic incoherent light (PILER-light) in the body of mice infected by lethal and therapeutic (sub-lethal) doses of A/PR/8/34(H1N1) flu virus.

Methods

A(H1N1/PR/8/34) flu virus was used in the study. The experiments were conducted on albino mice of Balb/c line with the body weight of 13–14 g with the device – a source of polarized polychromatic incoherent light (PILER-light) with the wave length of 400–2000 nm and power 2,4 joule/cm²•min.

An active A A/PR/8/34(H1N1) flu virus was obtained, and its lethal dose for mice was determined.

The role of polarized PILER-light effect on survival of mice infected with a lethal dose of flu A virus was determined during the experiment.

Results

The animals were divided into 4 groups, 10 mice each. The 1st group was infected with a lethal dose of flu A virus through the nose. The 2nd group received the same dose but underwent the course of treatment with PILER-light. The animals were exposed to radiation along the whole surface of their bodies on the back side (Fig.1). Every mouse was exposed to radiation 11 times for 6 minutes at every session. The 3rd group was exposed to PILER-light only (11 sessions for every mouse). The 4th group of mice received saline with diluted flu A virus in it.

On the first day after infection the mice were exposed to radiation every 1 and then 6 hours. The results of the study in Table 1 demonstrate that on the 5th day after being infected all the 100% of animals from the 1st group died. In the 2nd group the animals remained alive on the 14th day after infection. The observation showed that during the first two days mice were inert and had poor appetite. 4 days later these signs disappeared. In the 3rd group, where animals were exposed to polarized light only, all of them were active and healthy. All the animals from the 4th group receiving saline remained alive as well.

Light therapy of mice infected with a lethal dose of flu A virus (the 2nd group) determined that

proteinase activity in the blood serum decreased sharply in comparison with healthy mice (the 3rd group) exposed to light, but it was considerably higher than in the 1st group of mice without treatment.

Antihemagglutination activity in the lungs and blood serum of animals from the 2nd, 3rd and 4th groups was not determined. It is especially important that in the 2nd group of animals receiving a lethal dose of flu A virus and underwent the course of light therapy, flu A virus was not found.

PILER-light was applied 1 hour after infection when influenza virus A had already penetrated into the cell, and 6 hours after infection when the 1st cycle of virus reproduction had been completed and it entered the intercellular space. Polarized light can be suggested to promote destruction of cellular enzymes responsible for hemagglutinin (HA) break down of influenza virus A into two subunits HA₁ and HA₂, that in their turn are responsible for the penetration of the flu virus into the host's cells and its reproduction in them, that is, its pathogenicity.

Table 2 presents the results of protein content changes after polarize light effect produced. A sharp decrease of protein content in the 1st group was found (101,0±9,8 mg/ml), while in the 2nd group of animals its content did not change in comparison with the control 4th group (176,0±16,7 and 177,0±18,0 mg/ml respectively). In the 3rd group the amount of protein increased to 431,0±45,0 mg/ml. It might happen at the expense of proteinase inhibitor increase.

Examination of the lung and liver tissues of mice determined simultaneous increase of saprophytes (*Bacillus subtilis*) and micrococci, which is indicative of bacteremia. Therefore, exposure to polarized light increases protein content in the lungs, especially in healthy mice, though the effect was reliable in case of flu infection.

After the animals infected with a lethal dose of A/PR/8/34(H1N1) flu virus were exposed to the polarized light (on the whole surface of the back of mice), the development of flu infection stopped and the animals remained alive till the end of the experiment (during 14 days).

Therefore, polarized light produces a protective action on the animals with experimental flu infection.

In the group of animals infected with a therapeutic (sub-lethal) dose of flu A virus and exposed to the effect of polarized light 80% of animals survived (remained alive on the 15th day after infection). Therefore, polarized polychromatic light can be considered to be an effective therapeutic means in mice infected with influenza virus. It is important that its major protective action is mostly stipulated by the correction of proteinase-inhibitor system.

In the group of sick animals after PILER-light effect a sharp decrease of the inhibitor tripsin in the blood serum was found – to 2,17±0,14 mg/ml in comparison with the control group – 130,98±9,4 mg/ml, and in the lungs of mice – increase of the inhibitor to 11,73±0,98 mg/ml compared to that of the control.

Survival rate in the control 6th group of animals (without PILER-light use) was 50%, and in the 7th group after PILER-light effect – 80%. That is, the reproduction of flu A virus in the body of mice became slow.

Therefore, survival of mice infected with a lethal dose of influenza A virus under PILER-light effect is likely to be the result of an increased content of inhibitor in the lungs compared with that of proteinase activity. This mechanism can be suggested to work in case of diseases caused by other respiratory viruses.

Discussion

Survival of mice infected with a lethal dose of influenza A virus was 50%, and with a therapeutic dose of influenza A virus was 80% in comparison with the control group. Polarized light promoted slow reproduction of influenza A virus in the body of mice.

In the group of mice infected with a therapeutic dose of influenza A virus after PILER-light effect the content of the inhibitor tripsin decreased sharply ($p < 0,001$) – to 2,17±0,14 mg/ml in comparison with the control group (130,98±9,4 units/ml), and in the lungs of mice the inhibitor content increased to 11,73±0,98 mg/ml.

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Figure 1. Polarized light (PILER-light) effect on animals (mice) from the side of the head (1) and back (2)

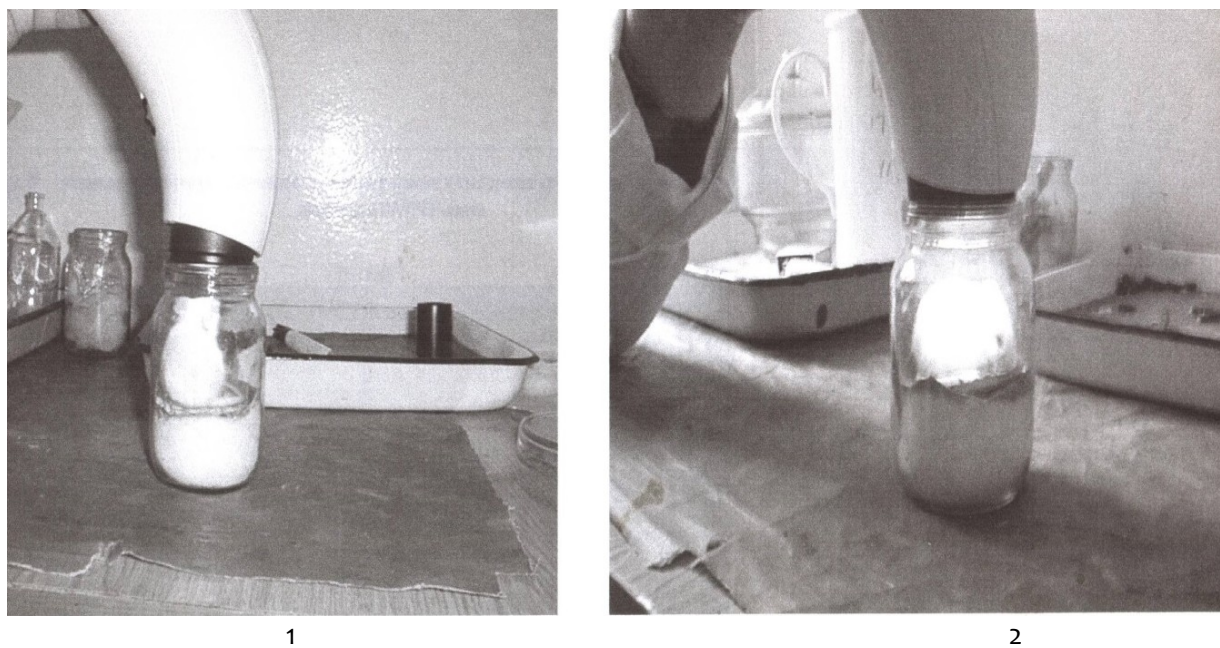


Table 1. Alternation of proteinase activity in mice infected with A/PR/8/34(H1N1) flu virus after polarized light effect
(n = 24, M±m)

Nº group	Name of the group	Proteinase activity in the lungs of mice 14 days after infection, units/ml	Proteinase activity in the blood plasma of mice, units/ml (mixed test)
1	Influenza virus A	125,5±49,5	387±15,8
2	Influenza virus A + PILER-light	182,0±49,25	80±7,8
3	PILER-light (control)	192,8±50,93	267±31,2
4	Saline (control)	229±53,71	74±6,8

Table 2. Protein content in the body of mice infected with A/PR/8/34(H1N1) flu virus after effect produced by polarized light ($n = 24, M \pm m$)

Nº groups	Name of the group	Protein in the lungs of mice 14 days after infection, mg/ml	Protein in the blood serum of mice, mg/ml
1	Influenza virus A	10,06±0,63	11,50±0,54
2	Influenza virus A + PILER-light	17,58±3,33	11,50±0,47
3	PILER-light (control)	43,12±2,24	9,20±0,45
4	Saline (control)	17,68±0,76	11,0±0,51

Figure 2. Infectious and hemagglutinin titers of flu A virus in the lungs and blood serum of mice on the 14th day after infection with a therapeutic (sub-lethal) dose (0,5 LD₅₀) of flu A virus grown on chicken embryos after polarized light effect;
1 – hemagglutinin titer; 2 – infectious titer

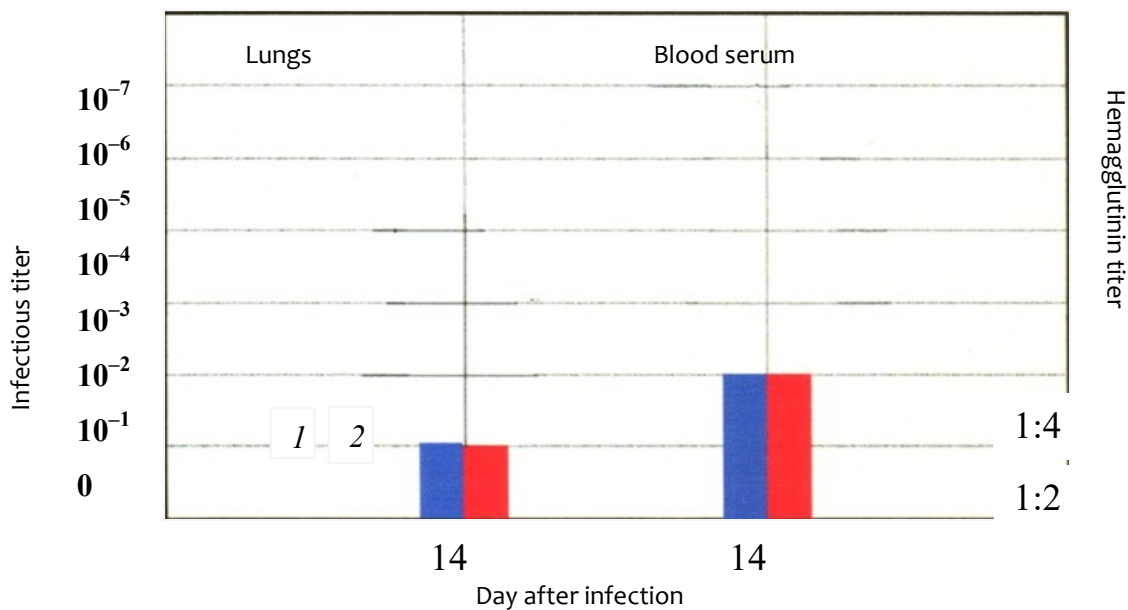


Figure 3. Proteolytic activity and content of the inhibitor in the lungs and blood serum of mice infected with a therapeutic (sub-lethal) dose of flu A virus before and after PILER-light effect: 1 – in the lungs of mice from the 6th group; 2 – in the blood serum of mice from the 6th group; 3 – in the lungs of mice from the 7th group; 4 – in the blood serum of mice from the 7th group. It occurred at the expense of the protease system changes.

