

# Post-Covid Vascular Syndrome – Ultrasound Diagnosis and Correction of the Vascular Bed: Evidence-based Clinical and Hemodynamic Correlations



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## The cardiovascular system is one of the main targets for COVID-19

- It has been proven that after COVID-19, the risk of developing HF, arrhythmias and BI increases in 3 times (95% CI 2.7-3.2)[1].
- SARS-CoV-2-induced damage to the endothelium is associated with the appearance of endothelial dysfunction in the form of vasoconstriction, activation of the blood coagulation and cytokine storm [2].
- Indirect negative influence on cardiomyocytes is associated with the development of the systemic inflammatory response, decrease in blood supply[3].

*Blood flow is the basis of the body vital activity*



1. Ramadan M. S. et al., 2021
2. <https://health-ua.com/article/67628-sertcevosudinn-uskladnennya-koronavirusno-hvorobi-na-sho-neobhdno-zvernuti-u>
3. Adu-Amankwaah J. et al., 2021

- The progression of COVID-19 and the appearance of post-Covid syndrome are associated with an increase in endothelial cells. The endothelium (like the lungs and the cardiovascular system) has a high density of ACE-2 receptors, through which SARS-CoV-2 penetrates into the endothelial system and destroys its work [4].
- A change in the functional activity of such an important endocrine organ as the endothelium results in a loss of control over blood coagulation, impaired regulation of vascular tone and arterial pressure, a change in the filtration function of the blood flow, short-term activity of the heart, metabolic supply to the brain. Impaired regulation of vasodilation and vasoconstriction, synthesis and inhibition of proliferative factors, fibrinolysis and thrombocyte aggregation, imbalance in producing of pro- and anti-inflammatory cytokines influence on all organs and systems [4].



## Why Vascular Screening is the primary method for assessing the cardiovascular system?

- ❖ Blood circulation is the basis for the body vital activity.
- ❖ Decrease in blood flow by 15-30% can lead to dysfunction of an organ and general cerebral symptoms of discomfort.
- ❖ Functioning of blood flow is characterized by approximately 100 hemodynamic parameters, which are within the normal range.
- ❖ If 3-5 of these parameters go beyond the norms, then this is considered a trigger for chaos in the vascular system.



## Why Vascular Screening is the primary method for assessing the cardiovascular system?

- ❖ A decrease in the level of blood flow within 50% leads to arteriovenous unbalancing, which in turn is the trigger for the impairment of the functions of the organ with different hemodynamic patterns.
- ❖ A significant reduction in the blood level by more than 60% is critical for the vitality of the patient's body. There is a risk of thrombi formation!

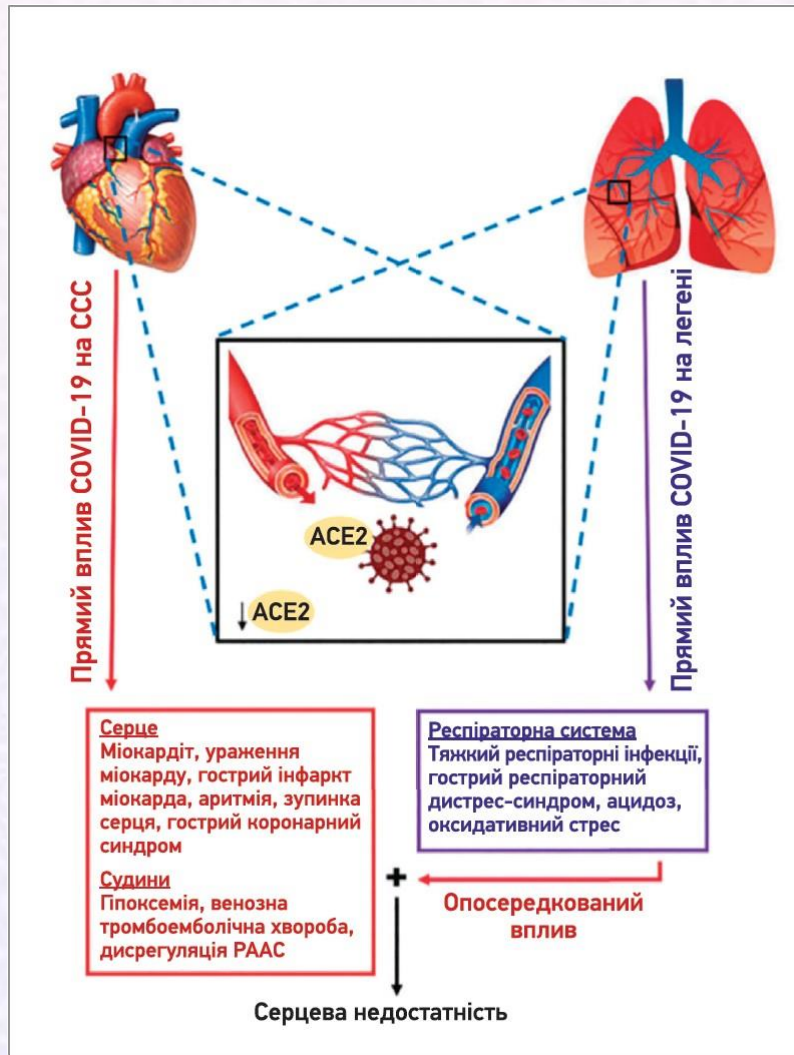


# AIM:

✓ To assess blood vessels condition in patients suffering from COVID with the aim of finding pathogenetic mechanisms of systemic failure in the living organism and ways to overcome the identified vascular pathology.



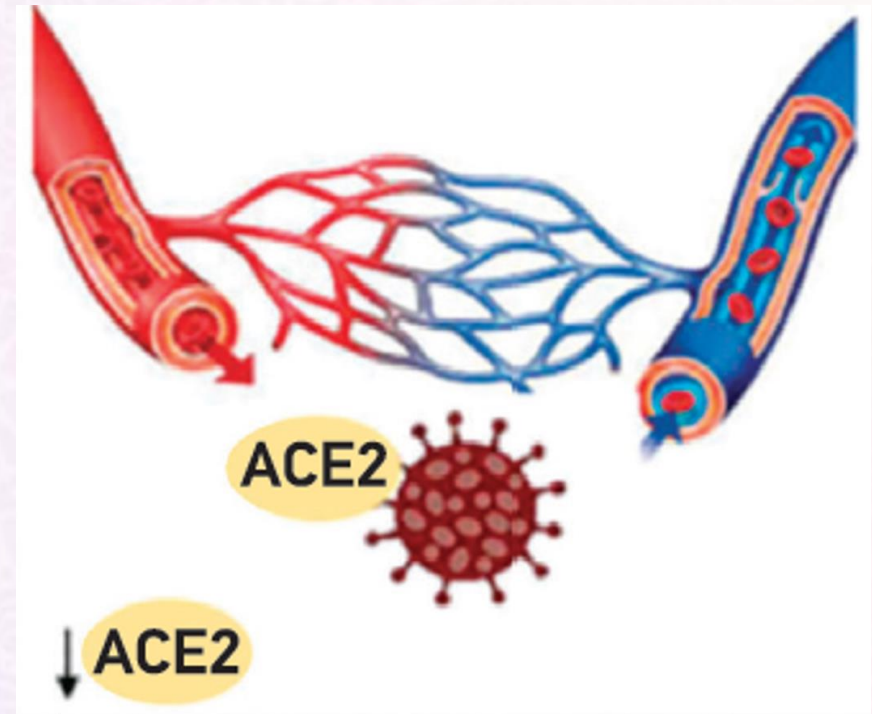
# Mechanisms of SARS-CoV-2 influence on the cardiovascular system



*Long Covid – hemodynamics progressively deteriorates at macro and micro levels*

# METHODS:

Ultrasound scanning, colour, energy and graphic dopplerography in applied angiology of main and peripheral arterial and venous channels with verification of distal microcirculation disorders by capillaroscopy method and technology of clinical-instrumental interpretation of vascular screening.



*Capillaries are arbiters for the healthy cardiovascular system*



# RESULTS:

➤ During 2020-2023, a complex cardiovascular examination of the vascular bed in various regional reservoirs (cerebral, limbic of the upper and lower extremities, coronary, renal, hepatic, etc.) has been carried out in order to find causes of general weakness and rapid fatigue, reduced work capacity, deterioration of visual acuity, sleep disorders, numbness of fingers and the skin discoloration of hands and/or feet, pain in joints, feeling of coldness in legs.

*In the 3<sup>rd</sup> stage of the illness, Covid-associated proteins form microthrombosis and angiopathy in the microcirculatory area*



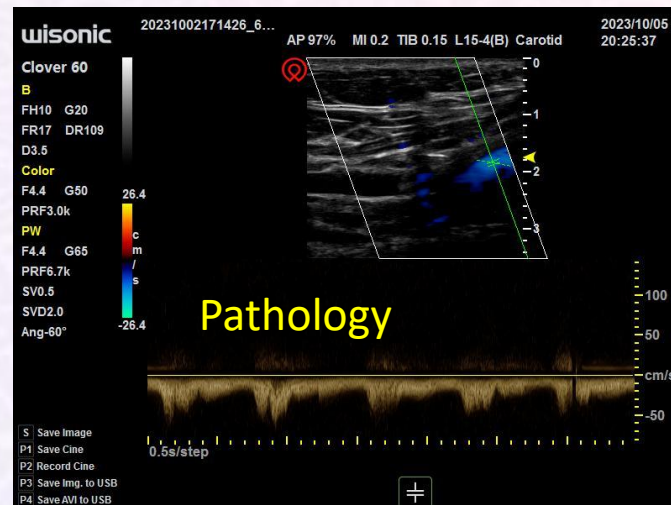
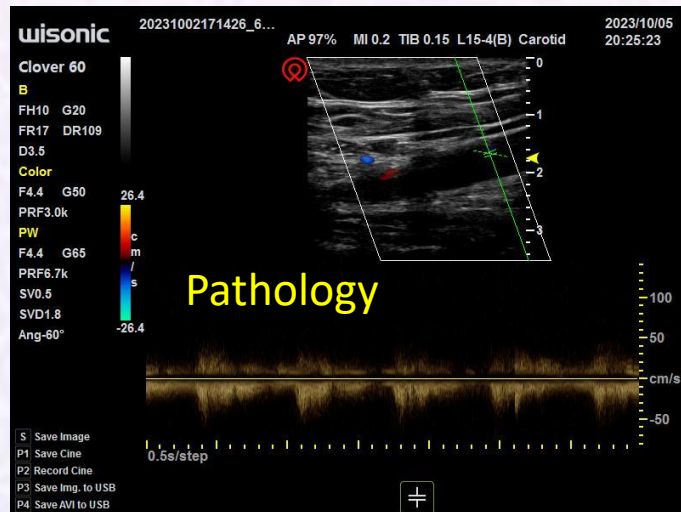
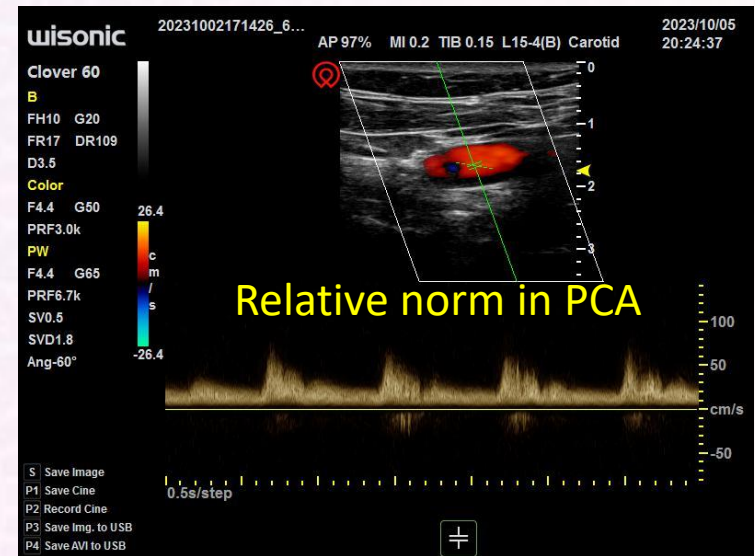
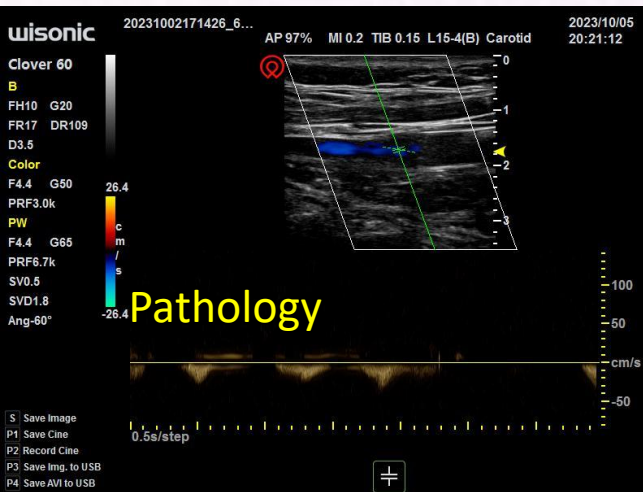
# RESULTS:

- We have conducted hemodynamic studies both at the macroangiological level (complex ultrasound) and at the level of assessing microcirculation in fingers.

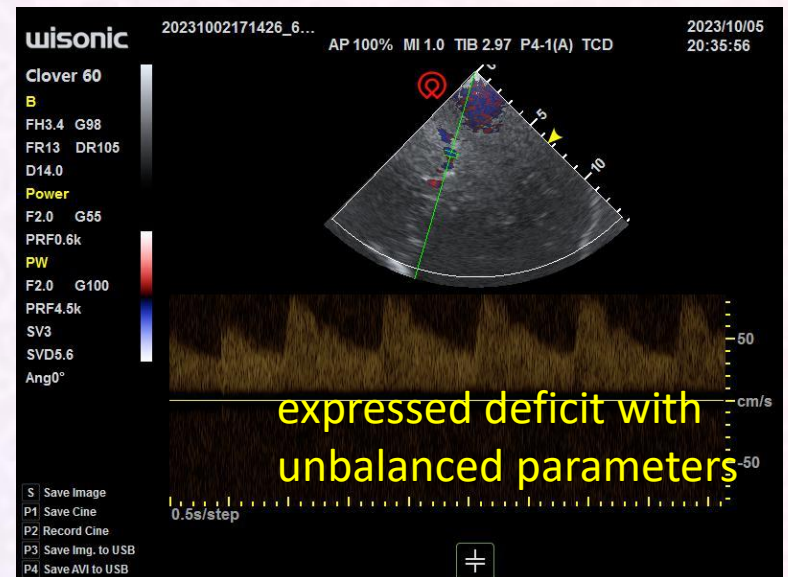
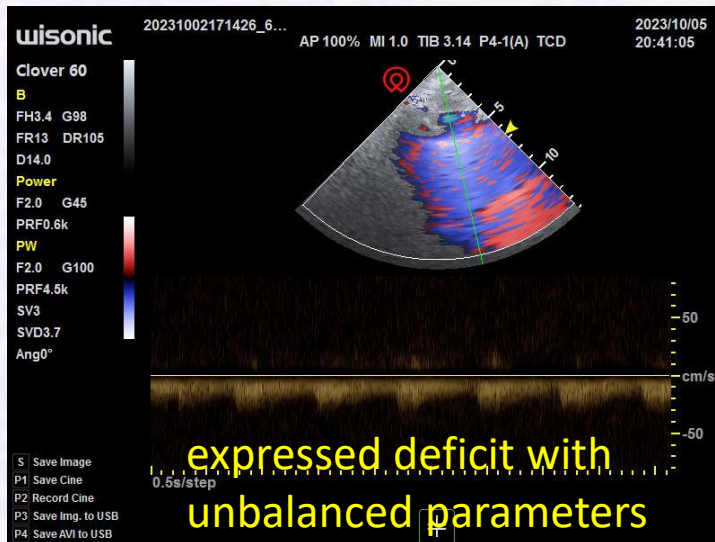
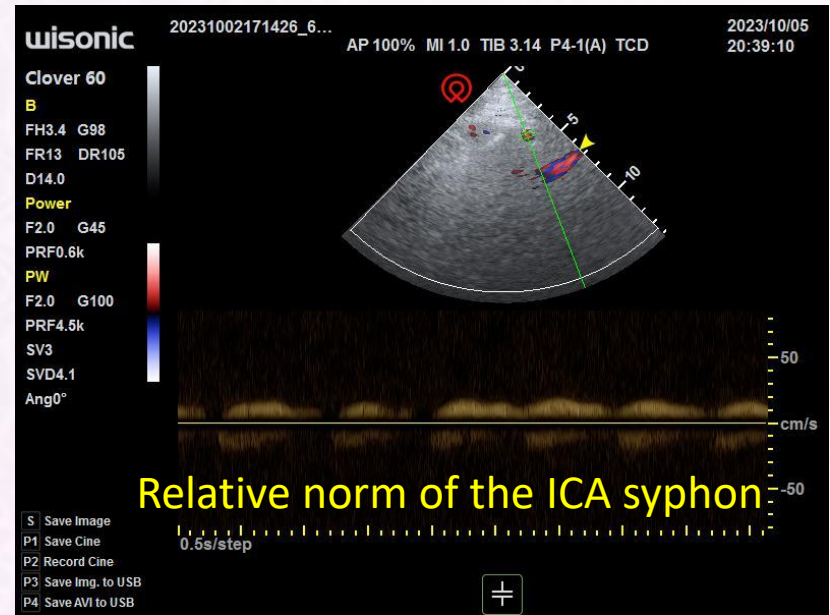
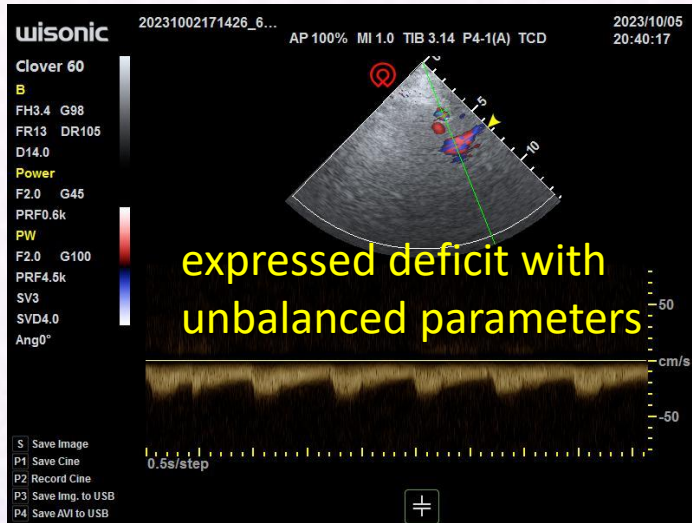
*Covid negatively affects the dynamic viscosity of blood*



# COMPLEX ULTRASOUND

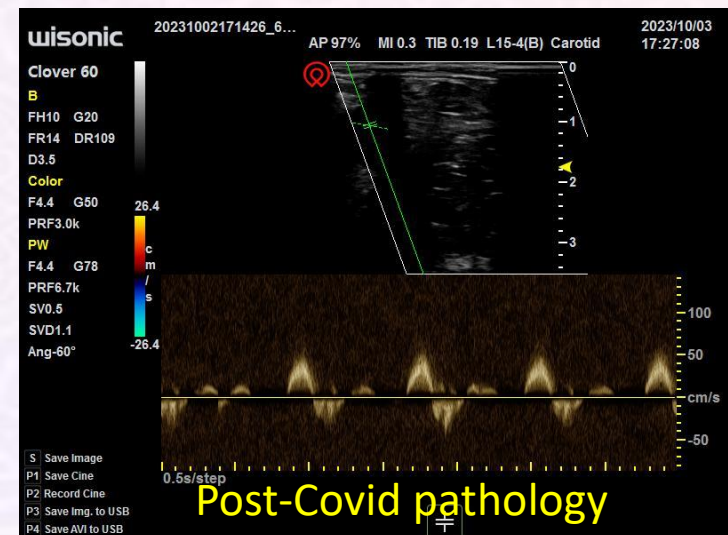
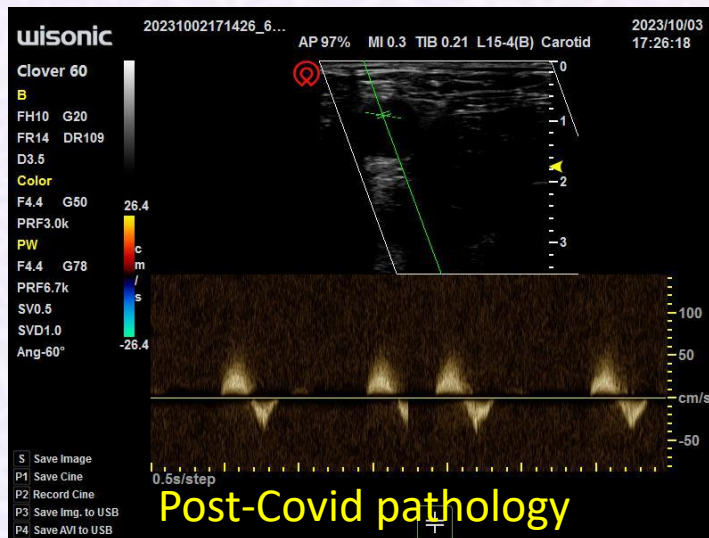
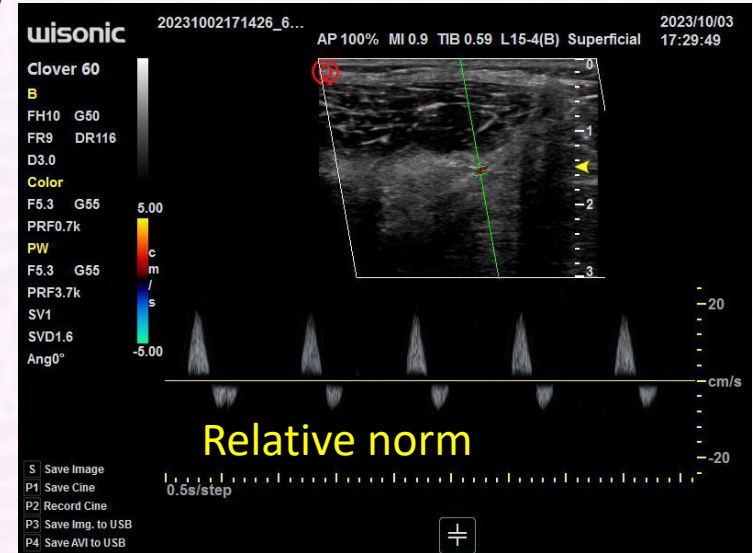
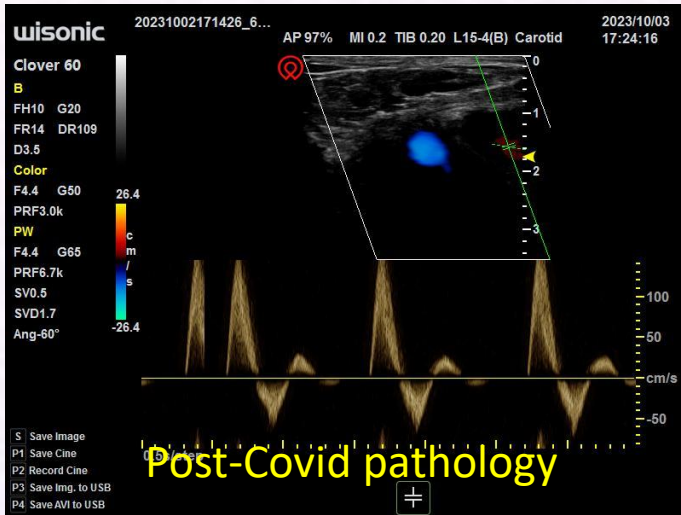


# COMPLEX ULTRASOUND



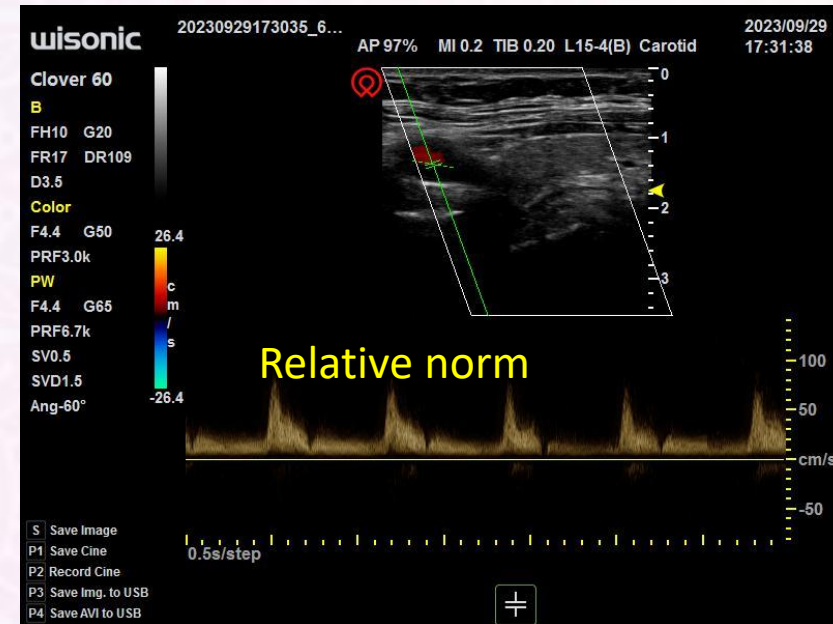
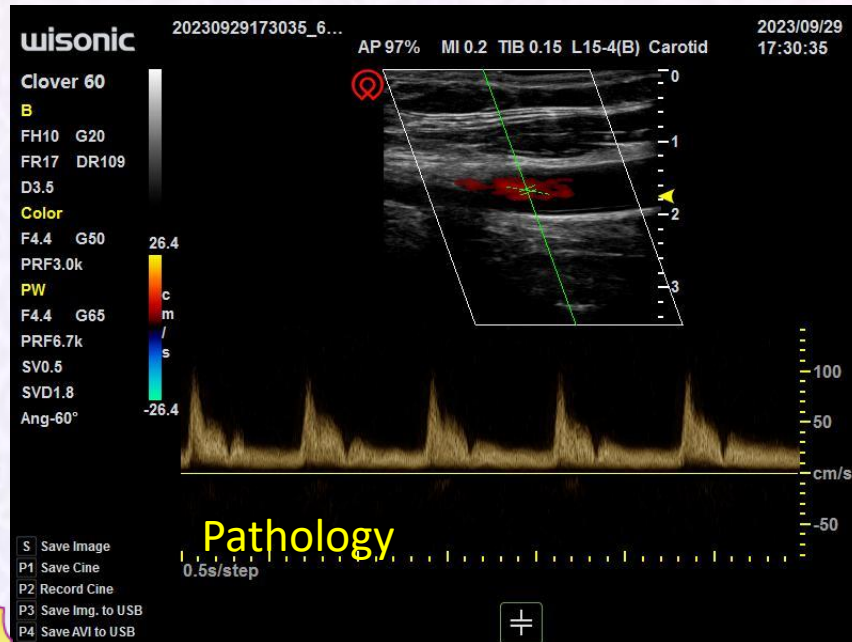
# COMPLEX ULTRASOUND

## Femoral artery



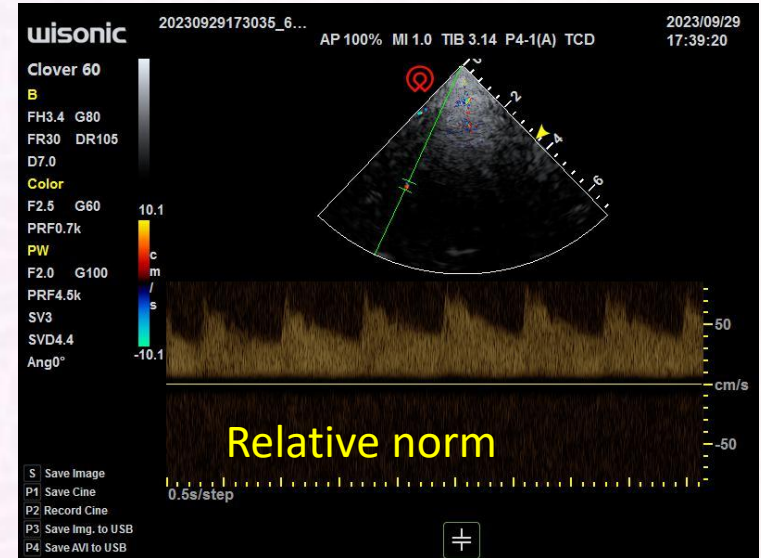
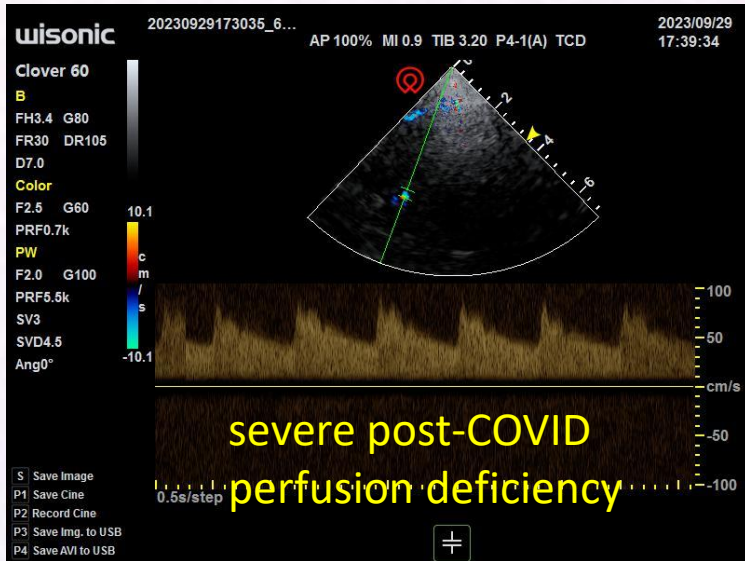
# COMPLEX ULTRASOUND

## Posterior carotid artery

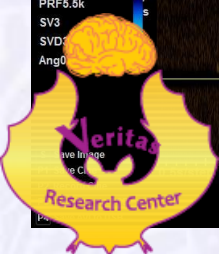
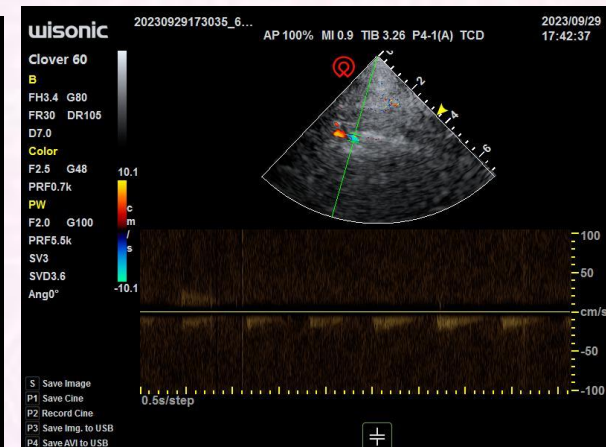
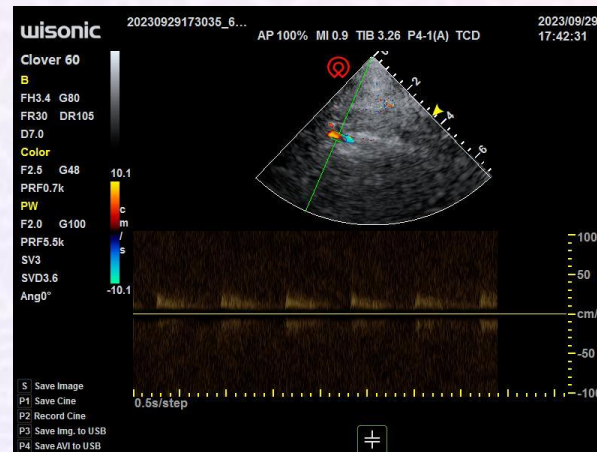
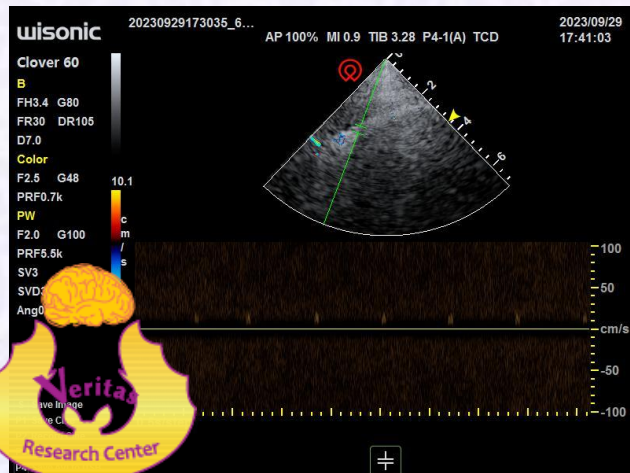


# COMPLEX ULTRASOUND

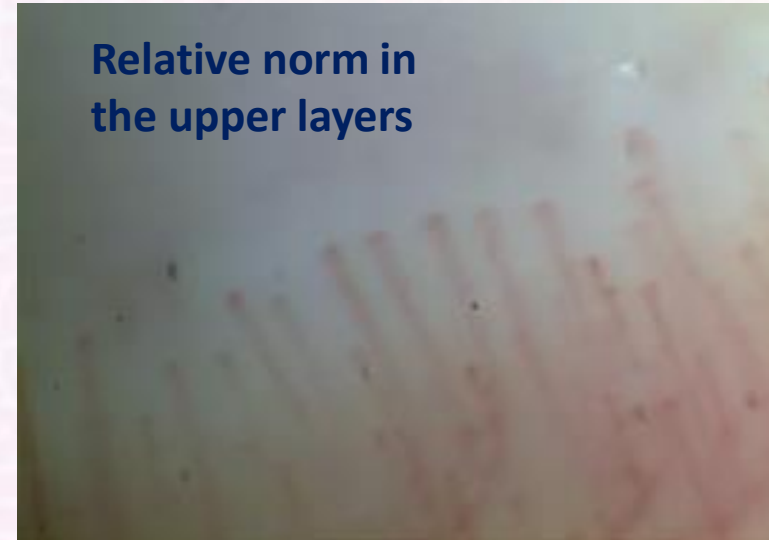
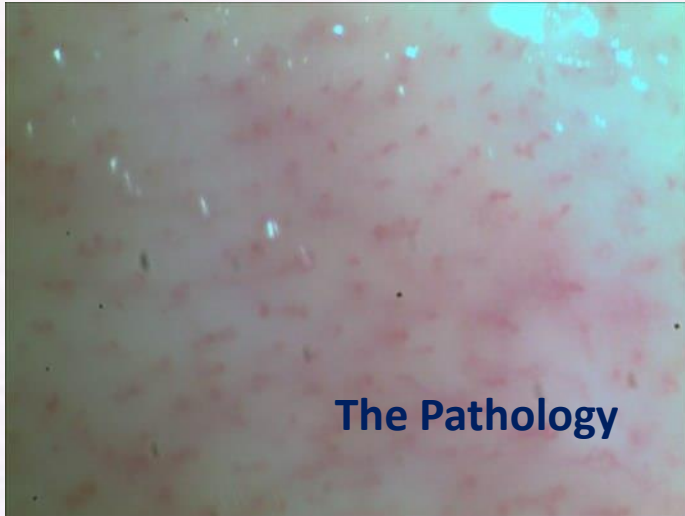
## The ICA siphon



## severe post-COVID perfusion deficiency



# MICROCIRCULATION IN FINGERS







**A method for ultrasound diagnostics of vessels in the brain. Patent № 10262 A on 19.07.95**



**A method for assessment of the regional angioarchitectonics. Patent № 67707 A on 31.12.03**



**A method of assessment of a gray-scaled scanned image. Patent № 67708 A on 31.12.03**



**A method for neurorehabilitation of patients suffering from apallic syndrome. Patent № 72725 A on 31.12.03**



**A method for assessment disorders of microcirculation in norm and with pathology in patients of different ages with the help of smart capillaroscopy. Patent № 67709 A on 31.12.03**



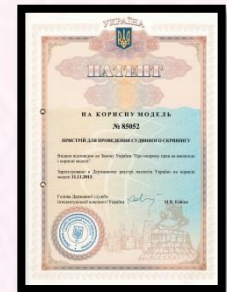
**A method for application of combination of medicines for correction of the arteriovenous disbalance. Patent № 72868 A on 31.12.03**



**A method for treatment of convulsive syndrome. Patent № 71505 A on 31.12.03**

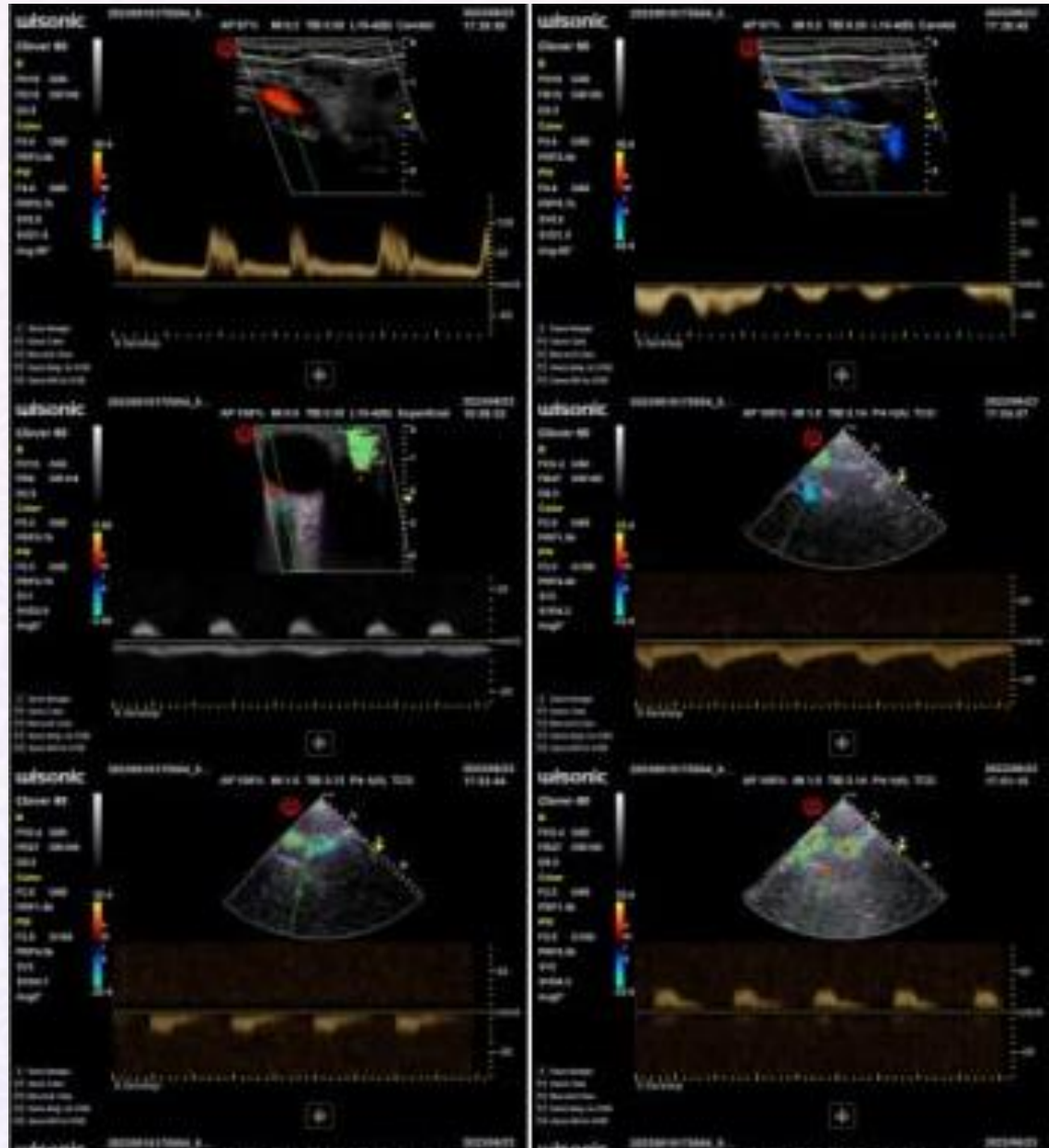


**A device for the capillary circulation registration. Patent № 22944 on 25.05.07**

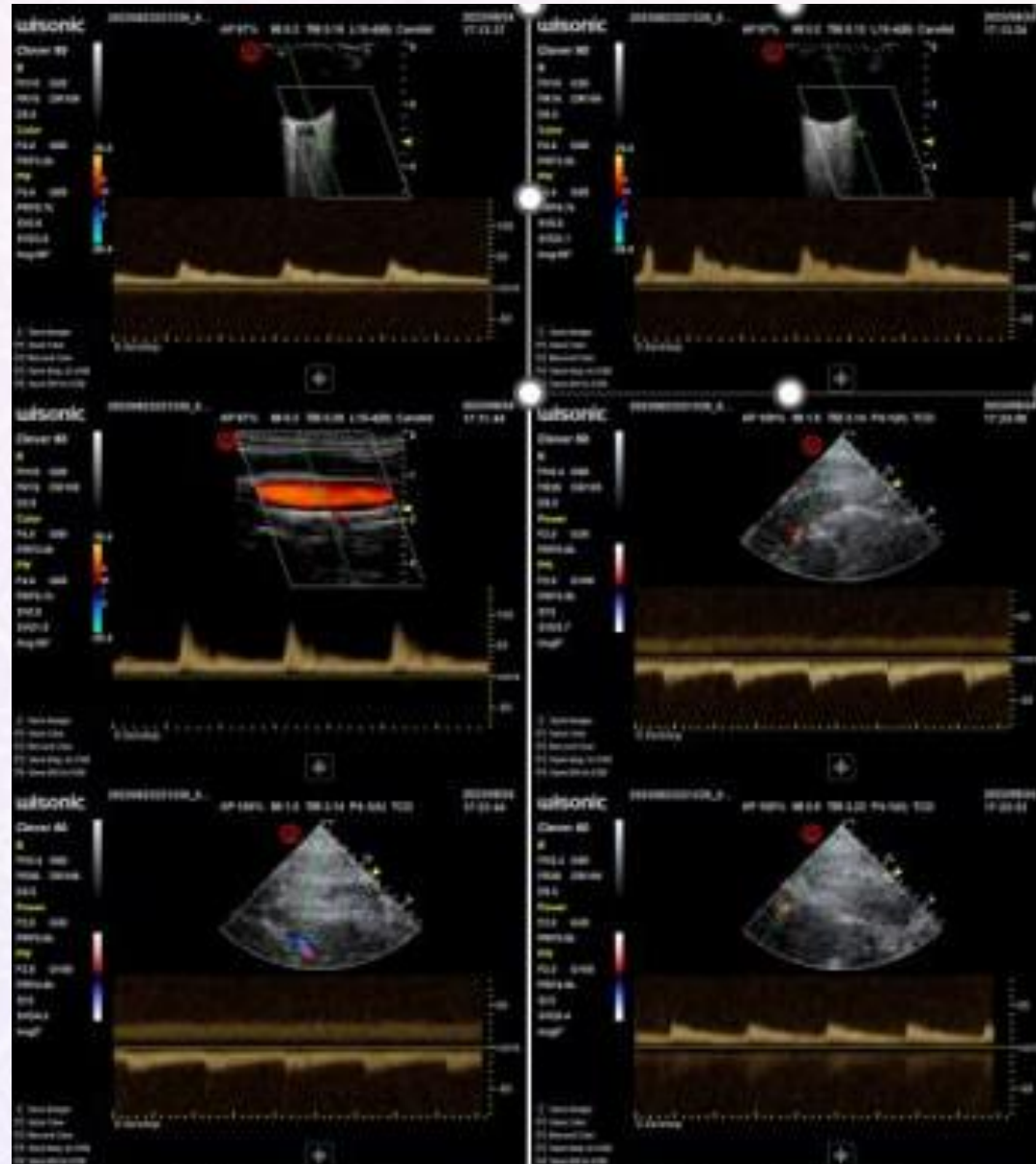


**A device for the vascular screening. Patent № 85052 as of 11.11.2013**

Prior to  
treatment



In 3 weeks  
after  
treatment

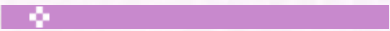


# RESULTS:

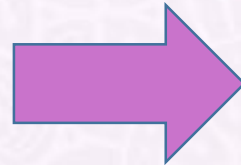


The risk of developing thrombosis and thromboembolism in the main vessels increased from the 3rd week after the start of COVID and without adequate treatment, after 2-3 months it led to thrombosis and thromboembolism with a clinical picture of sudden deterioration, unreasonable jumps in blood pressure and a high risk to life

# RESULTS:



**The most threatening pattern for restoring blood supply:**



!occlusive  
 microthromboangiopathy of  
 the deep layers of the  
 microcirculatory bed, which  
 provoked blood rheology  
 disorders, pathological  
 structural transformations of  
 capillaries towards  
 rheumatic and/or  
 oncological patterns.

Applying the Vascular Screening Technology we have found specific patterns of microcirculation disorders, in peripheral and main blood supply:

pathological types of mixed arteriovenous balance

violation of elastic-tonic properties of arteries and veins

dominance of venous and venular hypertension

extravasal compression of small arteries and arteriole perivascular edema

Method of evaluation of microcirculation disorders within the norm and pathology in people of all ages with the help of the capillaroscopy:  
State Patent of Ukraine. No. 67709A; 31.12.2003



# RESULTS:

➤ In the conditions of resuscitation, the microcirculatory reserve was already blocked by occlusive microthromboangiopathy, which served as the reason for the impossibility of resuscitation measures (the cardiovascular system reacted paradoxically, not keeping blood pressure within physiological limits).



*“Covid is a special shout out to me as an expert in applied angiology and hemodynamics”*

*Ulyana Lushchyk  
Acad. of ATSc of Ukraine*

# CONCLUSIONS:

- ❖ Combining complex ultrasound in applied macroangiology and vascular screening technology in applied microangiology enables us to form a global vision of the condition of hemodynamics in the body after suffering from COVID and to look for non-standard, personalized approaches to restoring blood supply in the entire cardiovascular system, taking into account the identified thrombotic lesions.







**Thank you  
for your attention**

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