After all, Professor Nikolai L. Volodos is the first indisputable inventor of EVAR and TEVAR. The real story how it has been developed.

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Until quite recently, a great part of the international surgical community was not aware of the outstanding scientific and practical achievements of Professor Nikolai L. Volodos (Pic.1). The influence of innovation and clinical application of vascular stent-grafts. By the start of N.L. Volodos team’s work, there was no such prosthesis in the world. The main purpose of it was just creation of the self-fixing synthetic prosthesis as the key element in stent grafting. For this purpose, they invented, developed, and searched for the radial Z-shaped spring that being “sewed” to the graft was given the prosthesis the ability of self-fixing. So, for the first time in world practice a real self-fixing synthetic endograft was created. A similar Z-shaped structure was registered in the USA 5 months after that the patent had been registered in the USSR, and it was named the Giantuuro stent.

Many technical works has been performed in the Institute for Low Temperature Physics and Engineering (ILTPE) of the National Academy of Sciences of Ukraine headed by B. I. Verkin as Director, who established a special group at the ILTPE dealing with endoprosthetics.

Nikolai Volodos’ team studied the function of new created self-fixing synthetic endograft in models, including segments of cadaveric aorta, also in the conditions of blood pulsatile flow. Radial force parameters required for safety fixing of a spring and a graft in a vessel in the conditions of blood pulsatile flow were studied.

Yulia V. Kalashnikova (biophysicist) (pic.2) joined the team of Professor Volodos in August 1983 when the spring prostheses studies on dogs had been carried out at full speed. First, the Volodos’ team was searching for a method to isolate the spring from the blood flow to prevent potential toxicity due to metal oxides. The spring was covered by metallicizing: silver, gold, different alloys, and latex rubber and glue compositions. At N. L. Volodos’ request, stainless steel wire was manufactured in Moscow exclusively for his team by the Bauman Moscow State Technical University (at their pilot production). Biological investigations demonstrated good biocompatibility of the stainless wire with the body tissues (Pic.3-5).

A question arose: what effect the spring has on the prosthesis tissue? Tear strength of the prosthesis tissue was tested using special equipment. It was shown that in comparison with the zigzag radial spring the force needed to start prosthesis tissue tearing was 100 times more than the spring force.

There were also experiments in flush tests of prosthesis with springs (hereinafter referred to as endoprosthesis) to see how the endoprosthesis would behave in the vessel affected by the blood stream. At the first stage, water hammer tests were performed under different pressures in the system without a pulsatile flow. The next stage involved the experiments using pulsatile flow and heart-lung machine. No shifts of the prosthesis along the aorta were observed even with the capacity of 6 l/min and the impact of increased pressure of up to 400 mmHg. Thus, the self-locking synthetic prosthesis placed in the patient’s aorta and exerting pressure on the aortic wall using a fixing element (stent) was proved to resist to flushing by the blood stream. The results of the subsequently used by Prof. N. E. Terniik (Pic.8) for theoretical calculations of radial stiffness of the zigzag spring.

The development of the balloon catheter required the invention of the device protecting the syringes from destruction due to high pressure produced in the balloon catheter, thereby increasing the doctor’s operational safety (Pic.6-7). L.F. Yakovenko, Construction Engineer of ILTPE NASU participated in the development of the balloon catheter and was in charge of many technical issues, a team member. After the examination of spring radial force, a number of experiments were conducted on large dogs, which demonstrated good functioning and implantation of the endoprosthesis. It was the first experimental system which had very long mainlines of fluoroplastic and complicated and heavy devices for connection with the system. The whole endoprosthesis system was formed inside the filling part, which was subsequently pushed into the transport unit through the clamp coupling. Later it was found that the long length of those fluoroplastic mainlines produced high resistance and required great physical efforts to mount the endoprosthesis. It allowed Prof. N.L. Volodos for the first time ever in the world using this method in the clinic for iliac arterial aorta replacement (Pic.5-10).

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A number of experiments were performed 5-7 years earlier than they were applied abroad. However, it so happened that the literature showed that the method was just about developed and originally applied by foreign authors who applied it 5 years after N.L. Volodos. His developments despite of modern publications in national and foreign journals kept in the background until recent years.

Since 2012, due to the principal position of some foreign scientists, first-of-all, K. Ivansev (Sweden – Great Britain), this injustice was corrected. Since 2013, the several large historical sessions were performed within leading international congresses, where it was officially document supported (Phoenix, Arizona, USA, 2013 Edward Diethrich), Sao Paulo, Brazil, 2014 (Armando Lobato), Milan, Italy, 2014 (Germano Melis-Sano), Moscow, Russia, 2015 – A.N. Bakulev award (Academician L.A. Bokeria). The important role S. Debus (Germany) and A. Jawien (Poland) in international recognition of Volodos N.L. achievements must be emphasized. And finally, Porto, Portugal, ESVS – 2015 “In recognition of outstanding contribution of Professor Volodos and the team headed by him to the development of endovascular surgery, particularly, performing the first in the world procedure of endovascular stent graft implantation on May 4, 1985, the Executive Committee of European Society of vascular surgeons hereby certifies that Professor Nikolai L. Volodos was elected as the honour member of the Society (Porto, September 24, 2015). Two weeks after his death he was also awarded a honorary membership of the SVS.

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