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THE PHENOMENON OF DEMIKHOV.
In the Sklifosovsky Institute (1960−1986).
The Institute Scientific Session on the treatment of coronary disease (November 16−18, 1960)

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The article has covered the first 5 months of V.P. Demikhov's working at N.V. Sklifosovsky Research Institute for Emergency Medicine (since June 1960), and described the Institute Scientific Session held in November 1960 and dedicated to the 150th anniversary of the Sheremetev Hospital foundation. Among the issues at that Session, the topic of coronary artery failure and its treatment was discussed. However, V.P. Demikhov's presentation on his original technique of direct myocardial revascularization by means of forming the anastomosis between the internal mammary and coronary arteries was greeted coolly. The author believes that, probably, at that time, in November 1960, the idea of making such an operation in clinic could occur to Dr. V.I. Kolesov, one of the Session

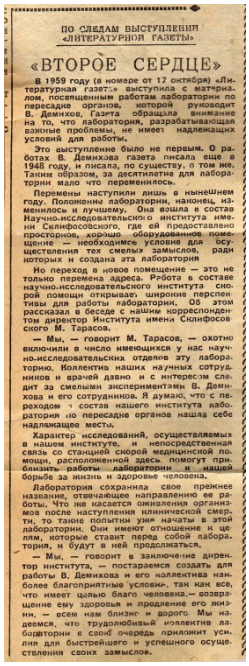
participants from Leningrad, and he embodied the idea in 1964 after he had mastered V.P. Demikhov's technique in the experiment.

Keywords: V.P. Demikhov, Sklifosovsky Institute for Emergency Medicine, November 1960, treatment of coronary artery insufficiency

AIVB, anterior interventricular branch
ITA, internal thoracic artery

Here we are dating back to the time when almost half a year had passed since that historic Scientific Council Session of N.V. Sklifosovsky Institute for Emergency Medicine that took place on June 22, 1960, when V.P. Demikhov set out a program of his research, which ultimate goal was heart transplantation in clinic. And here we have briefly described the conditions under which he had to work for the nearest quarter of the century. (Fig. 1−3).

Fig. 1. V.P. Demikhov, the Head of the Laboratory for Transplantation of Revitalized Organs at N.V. Sklifosovsky Research Institute for Emergency Medicine. Pencil, paper. 1960



ПО СЛЕДАМ ВЫСТУПЛЕНИЙ «ЛИТЕРАТУРНОЙ ГАЗЕТЫ»

«ВТОРОЕ СЕРДЦЕ»

В 1959 году (в номере от 17 октября) «Литературная газета» выступила с материалом, посвященным работам лаборатории по пересадке органов, которой руководит В. Демихов. Газета обращала внимание на то, что лаборатория, разрабатывающая важные проблемы, не имеет надлежащих условий для работы.

Это выступление было не первым. О работах В. Демихова газета писала еще в 1948 году, и писала, по существу, о том же. Таким образом, за десятилетие для лаборатории мало что переменилось.

Перемены наступили лишь в нынешнем году. Поломаны лаборатории, наконец, изменилось и лучшему. Она вошла в состав Научно-исследовательского института имени Склифосовского, где ей предоставлено просторное, хорошо оборудованное помещение — необходимое условие для осуществления тех смелых замыслов, ради которых и создана эта лаборатория.

Но переход в новое помещение — это не только перемена адреса. Работа в составе научно-исследовательского института скорой помощи открывает широкие перспективы для работы лаборатории. Об этом рассказал в беседе с нашим корреспондентом директор Института имени Склифосовского М. Тарасов.

— Мы, — говорит М. Тарасов, — охотно включили в число имеющихся у нас научно-исследовательских отделов эту лабораторию. Коллектив наших научных сотрудников и врачей давно и с интересом следит за смелыми экспериментами В. Демихова и его сотрудников. Я думаю, что с переходом в состав нашего института лаборатория по пересадке органов нашла себе надлежащее место.

Характер исследований, осуществляемых в нашем институте, и непосредственная связь со станцией скорой медицинской помощи, расположенной здесь, помогут приблизить работы лаборатории к нашей борьбе за жизнь и здоровье человека.

Лаборатория сохранила свое прежнее название, отвечающее направлению ее работы. Что же касается оживления организмов после наступления клинической смерти, то такие попытки уже начаты в этой лаборатории. Они имеют отношение к целям, которые ставит перед собой лаборатория, и будут в ней продолжаться.

— Мы, — говорит в заключение директор института, — постараемся создать для работы В. Демихова и его коллектива наиболее благоприятные условия, так как все, что имеет целью благо человека,— возвращение ему здоровья и продление его жизни, — всем нам близко и дорого. Мы надеемся, что трудолюбивый коллектив лаборатории в свою очередь приложит усилия для быстрейшего и успешного осуществления своих замыслов.

Fig. 2. A note from the Literary Newspaper about the start of V.P. Demikhov's work at N.V. Sklifosovsky Research Institute for Emergency Medicine. 1960

Fig. 3. Dr. M.M. Tarasov (2nd left), the Director of the Sklifosovsky Research Institute for Emergency Medicine, an Honored Doctor of the Ukrainian SSR, awarded with the Order of Lenin, and Professor P.I. Androsov (1st right) with American surgeons. May, 1960

The Laboratory headed by V.P. Demikhov was placed in the basement of the building located on the corner of the Garden Ring (the Sukharevskaya Square) and the 1st Koptelsky Lane in Moscow. There was a polyclinic housed in that building on the side facing the Sukharevskaya Square, and an ambulance station on the other side. Now there is a Branch No. 48 of the Main Bureau of Medical and Social Expertise in the Moscow Region in this building; and nowadays the ambulances are coming up to the far end of the building from the Square, as it was used to before, in 1960. (Fig. 4).

Fig. 4. The building of Branch No. 48 of the Main Moscow Region Bureau of Medical and Social Expertise located at 5/1 Sukharevskaya Square. View from the 1st Koptelsky Lane. The building used to house the Laboratory for Transplantation of Revitalized Organs. Photo, 2016

If one entered the building from the Koptelsky Lane, there was V.P. Demikhov's office in a small room, long as a pencil, immediately to the right from the entrance (Fig. 5). Now this room is a place where a guard service is

based. Through the second door of Demikhov's office one could go out into a small corridor perpendicular to the office, which, if walking along it to the right, led to a staircase descending to the basement.

Passing the boiler room located right under the office, and through several rooms, a visitor could enter a long corridor under the building, from which the doors on the right and on the left led to small rooms with tiled walls. That was the Laboratory for Transplantation of Revitalized Organs, without windows and ventilation. But it had two advantages.

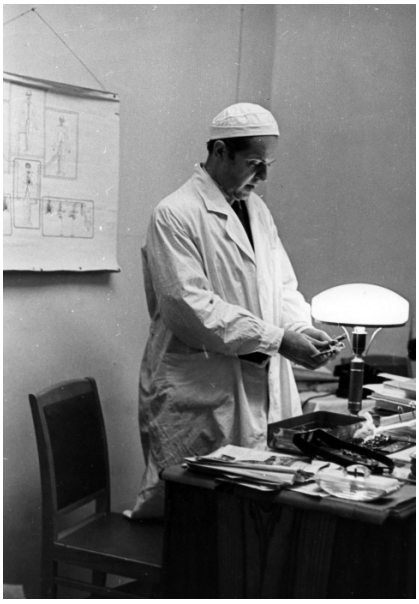


Fig. 5. V.P. Demikhov is in his office. 1960's.

First, the proximity of the ambulance station gave hope for a relatively rapid delivery of agonizing or deceased casualties to the Laboratory for their revitalization [1]. And second, there was another exit from the basement that led out into the courtyard of the Institute, passing through which by diagonal, one could get into the "laboratory branch" i.e. the building that housed its "operating theatre".

V.P. Demikhov equipped his Operating Room on the 2nd floor of the Anatomic Pathology Department (Fig. 6). Having passed two flights of stairs

leading upwards from the entrance, a visitor could get into a small passageway with the door leading to a narrow long Preoperative Room. There were several wash-hand basins and cabinets with surgical instruments. Through the door in the wall of the Preoperative Room, one could get into a fairly large room with two windows. There were two wooden operating tables and some kind of equipment, primitive by today's standards: anesthesia and respiratory assist devices, photoelectrocardiograph and kymograph with smoked paper (Fig. 7, 8).

Fig. 6. The building of the Anatomic Pathology Department in the Sklifosovsky Research Institute for Emergency Medicine where V.P. Demikhov's Operating Room was located on the 2nd floor (the window at the top right). Photo, 2016

Fig. 7. V.P. Demikhov's Operating Room. 1960's

Fig. 8. The same room at present. Photo, 2016

The entourage was completed with wooden tables for surgical instruments, two shadowless operating lamps with a storage battery unit, and a large round clock on the wall.

Going down the stairs from the entrance of Anatomic Pathology Laboratory building, one could come to the morgue. There was a special room for experimental dogs that were kept in individual cages there. That was convenient again: it was possible to bring the operated and recovering animals out for a walk in a court yard.

The only inconvenience was that the animals that were kept in the basement of the building on the 1st Koptelsky Lane had to be taken for surgery and carried back on the gurney through the yard. Well, it was good in summer when the sun was shining. And if it rained? Or was it winter and snowing?

But V.P.Demikhov was not embarrassed by all those "inconveniences". There was enough space for the dogs. The Operating Room with two wide windows was just gorgeous. He could never dream about it while was working at the Vishnevsky Institute or in the 1st MOLMI.

And, most importantly: he could get down to bringing his dream to life (Fig. 9), the dream that he voiced to his new colleagues from the Sklifosovsky Institute six months ago, and a year ago to the correspondent of The New York Times, namely the idea to start engrafting (onto the femoral vessels) or transplanting (into the chest) an additional heart to a human. But it was not there ... It turned out that nobody was eager to realize his ideas. Why?

Fig. 9. V.P. Demikhov (right) is operating. 1960's.

In November 1960, on the occasion of the 150th anniversary of the Sheremetev Hospital foundation, the Scientific Session of the Sklifosovsky Institute was held1[1] where a number of issues were discussed, including three issues of All-Union significance constituting the main scientific topics of the Institute:

1) Digestive system diseases (Topic No. 23);

2) Hypertension, atherosclerosis, and coronary insufficiency (Topic No. 22);

3) Trauma, industrial, agricultural, and domestic injuries, gunshot wounds (Topic No. 29).

The Session was quite representative. There were leading science experts in the Presidium at the Session Opening: Professor B.A. Petrov, the Chief Surgeon of the Sklifosovsky Institute, Academician A.N. Bakulev, the Scientific Leader of the Thoracic Surgery Institute of the USSR Academy of Medical Sciences (AMS), Professor B.S. Rozanov, the Chief Surgeon of the Botkin Hospital, Professor A.A. Vishnevsky, the Director of A.V. Vishnevsky Institute of Surgery, Full Member of the USSR AMS, and other leading surgeons of Moscow.

On the 2nd day of the Session on November 17, the issues of etiology, pathogenesis, clinic, diagnosis, and treatment of coronary insufficiency were considered among others. The meeting was chaired by Professor I.A. Kassirsky, the Head of the Internal Medicine Department of the Central Institute for Advanced Doctor's Training (CIUV), a Corresponding Member of the USSR AMS.

[1] Hospital at the Count Sheremetev's Hospice was opened in 1810.

The overwhelming majority of presentations were made by internists. There were only 4 presentations on the use of *surgical techniques for the treatment of coronary heart disease in clinic*.

Academician A.N.Bakulev made the presentation on the results of the acute myocardial infarction treatment by ligating internal thoracic arteries (ITAs) according D.Fieschi method. That work was performed by doctor Kh.N. Muratova under his supervision in the Thoracic Surgery Institute of the USSR AMS[2]. Professor V.I. Kazansky spoke as an apologist for the omentocardiopexy operation, and B.M.Khromov and K.V.Lapkin presented their experience in the treatment of angina pectoris and myocardial infarction with novocaine blockades of the cardiac-aortic plexus of the heart, and B.M.Khromov proposed an original technique to achieve that purpose.

The presentations had been made and, most likely, received the audience's approval. But did they say anything new, and promising? No, they did not. First, because all those methods were developed as far back as in the 1920s-1940s, and second, none of them provided the so-called *direct revascularization of myocardium,* and therefore, there was no prospect, as time showed later. That would become clear a few years later when all those techniques, once being modern, suddenly went down in history[3].

But at that Session, there was a presentation made on a new surgical technique to treat coronary insufficiency, which was novel both for Russian and also for world surgery, and which continues being actively used and improved to this day. That presentation was made by V.P. Demikhov. In our previous article, we mentioned that he first reported this technique in the

[2] In 1963, Kh.N. Muratova defended her doctoral thesis on the topic "Surgical treatment of chronic coronary insufficiency," in which she summarized the results of those studies.

[3] The world's first clinical mammary-coronary anastomosis was performed by V.I. Kolesov in 1964.

walls of Sklifosovsky Institute on June 22 of the same year, but he mentioned it just briefly, simply stating the fact of having such a technique. At the Session, he was given the opportunity to make a more detailed presentation of that technique to a wider audience of practical surgeons.

Worthwhile to mention that it was not his first presentation. In 1953, V.P. Demikhov reported his originally developed technique of coronary-mammary anastomosis[4] for the treatment of coronary insufficiency 1) at the retreat session of the USSR Academy of Medical Sciences in Tomsk; 2) at a Meeting of the Surgical Society of Moscow and the Moscow Region in Moscow; 3) in the newspaper "Meditsinsky Rabotnik" [*Medical Care Provider*]. Could not be a wider approbation, both in front of the academic and practical surgeons, and in front of the medical community of the country. But there came no response to his presentations. However, during the opening of the XXVI All-Union Congress of Surgeons in January 1955, its Chairman A.N. Bakulev drew the attention of the delegates to the surgical technique developed by V.P. Demikhov, but even after that, none of the scientists or surgeons was interested in it.

Demikhov described the technique of the operation and the protocols of several successful experiments in his book "Experimental Transplantation of Vital Organs" (1960). The results, even by today's standards, were impressive. By ligating the mouth of the anterior interventricular branch (AIVB) of the left coronary artery in a dog, the surgeon modeled an acute coronary syndrome, and then by making an anastomosis between the ITA stump and the distal end of the AIVB, restored the blood supply to the myocardium. The mortality of the animals in the control group (with ligated AIVB) was 100%. The mortality of the animals from the main group (with

[4] In his presentations, V.P. Demikhov called his technique in this way

anastomosis) was zero. What would be more evident! Moreover, the anastomosis had to be made before the onset of ventricular fibrillation and it took V.P. Demikhov only 55 minutes to masterly perform it according to E.Payr's technique and using original metal tubes - bushings!

In his presentation at the Session, he, in fact, told about that once again, trying to "reach out" to the surgical minds and hearts of the Session delegates. Along with a simple and clear presentation of the method and proving its efficacy with a 7-year-old (!) survival of the dog with a mammary-coronary anastomosis and a preliminary ligated AIVB, V.P. Demikhov severely criticized Fieschi's operation, showing that the ligation of the ITA did not save the dogs with the occluded AIVB from the inevitable death. Perhaps, such a way of proof seemed tactless to many of the Session participants because it "nullified" the results just reported by A.N. Bakulev; but V.P. Demikhov went to the verity in the shortest possible way, regardless of authority:

> "From the point of view of the modern physiology of blood circulation and the pathology of coronary sclerosis, the proposal to improve the coronary circulation by only ligating the thoracic artery is erroneous. <...> From the point of view of improving the coronary circulation, the operation proposed by Fieschi is unpromising "[2, p. 211] [5].

He also criticized a word-widely used operation of pericardocardiopexy, which in the USSR was advocated by B.V. Ognev. V.P. Demikhov told that:

> "... when the epicardium is coalesced to the surrounding tissues, the blood goes not in the direction of the coronary vessels, but, on the contrary, flows into the surrounding tissues. Therefore, from the physiological point, the coalescence of the heart with the surrounding

[5] The first digit in square brackets means the reference number; the second digit denotes the page in it.

tissues does not lead to an improvement in the coronary circulation, but on the contrary, [to its deterioration] "[2, p. 211].

The advocates of heart denervation with novocaine blockades G.Arnulf, B.M. Khromov, and K.V. Lapkin were also caught by his criticism:

"In our numerous heart transplantation experiments, we repeatedly observed heart attacks in the transplanted denervated heart, in which the neurogenic and spasmodic factors of infarction occurrence were excluded" [2, p. 211].

We emphasize the characteristic of V.P. Demikhov's manner of speaking, which demonstrates that on November 17, 1960, the Moscow surgeons and therapists were just listening not only an experimental biologist, but a thinker who looked ahead, far ahead to the future. After all, he did not simply repeat what he had been talking about 7 years before. He quite seriously suggested doing *"extra-urgent"* operations, making anastomoses in the cases of already *developed extensive myocardial infarctions* to control their further spread and to prevent new ones. In addition, V.P. Demikhov reported about the "mechanical heart" he had designed, which made it possible to maintain the blood circulation of a weakened heart during an operation on the coronary vessels (Fig. 10), and he *showed a film* about his operation.

Fig. 10. V.P. Demikhov and his original artificial heart device. 1960's

How did the listeners react to it? Let's listen to Professor A.A.Gerke:

> "V.P. Demikhov's proposal... does not have enough well-grounded evidence (! - SG). Experiments conducted in Prof. B.V.Petrovsky Clinic point out that the ligation of art. mammaria interna below art.pericardica provides an increase in blood circulation in the remaining vessels ... Brilliant results have been given by Prof. Khromov ... " [2, p. 282].

Let's interpret that in ordinary words. The fact that V.P. Demikhov's dog with ligated AIVB after the creation of coronary-mammary anastomosis lived for 7 years proved absolutely nothing. The ITA ligation and novocaine blockades were welcome.

Professor V.I. Kolesov (Fig. 11) echoed… Professor A.A. Gerke...:

> "The ligation of the internal thoracic artery improves the condition of patients with myocardial infarction, to which we have clinical evidence. <...> In patients with acute myocardial infarction, ... this operation must be supplemented with a retroperitoneal administration of novocaine ..." [2, p. 283].

And that was said by the surgeon who 4 years later would perform the first clinical operation of mammary-coronary anastomosis in the world[6] for chronic coronary insufficiency, and later on in acute myocardial infarction! But can one conclude from it that in November 1960 the revolutionary operation in coronary surgery had not yet matured in his mind?

Fig. 11. Professor V.I. Kolesov. 1960's

Apparently, there were other speeches that were *not published*, because V.P. Demikhov was slightly discouraged:

> "In the literature, two techniques are mixed somewhat as they are very close by names, but fundamentally different by essence. The Canadian surgeon Weinberg suggested suturing (more precisely: implanting - SG) the end of the internal thoracic artery in the affected area [of myocardium]. Professor A.A.Gerke spoke about this (that was not included in the transcript of Gerke's speech - SG). <...> But I do not implant the ligated end of the artery; on the contrary, I connect its end to the coronary artery [3]. This principle has widely justified itself on other peripheral vessels. <...>

[6] And although V.I. Kolesov called this intervention differently, rearranging the terms in places, the essence of the operation remained the same.

Therefore, I can not, first, agree with the identification of my technique as Professor Weinberg's technique and, second, I do not agree that this method fails to yield positive results. In addition, this has not yet been done on a human. The research in this filed conducted in the GDR by using our methodology had shown positive results.

As for Prof.Kolesov's presentation, I should say that many investigators are looking for anastomoses between the internal thoracic artery and the coronary artery. If these anastomoses exist, then they also exist in the ligated internal thoracic artery ... " [2, p. 285].

From that somewhat chaotic speech, one can conclude that perhaps it was just then when the idea of making direct anastomosis in clinic could occur to Vasily Ivanovich Kolesov, and 4 years later he accomplished it after having mastered the operation in experiments. After all, on the one hand, at that time he, as V.P. Demikhov said, already "was searching for anastomoses" (saying more precisely, for the possibility of their creation) between the internal thoracic and coronary arteries. And on the other hand, the technique of that operation was demonstrated for him in detail at the forum verbally, with diagrams and photographs, and later on it was shown on the screen; and it was mentioned that "it had not be performed in a human yet".

And whatever would V.I. Kolesov did say or write later about the originality of his idea, we are convinced that its source was V.P. Demikhov's presentation and his film demonstrated to V.V. Kolesov and other surgeons on November 17, 1960.

At the end of the meeting, the floor was taken by Professor I.A. Kassirsky, the Chairman (Fig. 12). In a lengthy speech, Prof. I.A. Kassirsky supported A.N. Bakulev in the fact that "*coronary artery pathology is currently prevalent*", and recognized "*a great contribution of surgeons in the theory of* (? - SG) *myocardial infarction* "and urged therapists and surgeons to further cooperation.

Fig. 12. Professor I.A. Kassirsky, a Full Member of the USSR Academy of Medical Sciences (since 1963). 1960's

As for the treatment methods for acute and chronic coronary insufficiency, I.A. Kassirsky expressed his solidarity with A.N.Bakulev in regard to the efficacy of Fieschi's operation in myocardial infarction, but he said that the issue "requires further study," simultaneously citing ...V.P. Demikhov:

> "One can not fully agree with the fact that the collateral circulation is ensured by the ligation of the internal thoracic artery, which is also shown by the experimental work of V.P. Demikhov ... "

However, he could not refrain from criticizing him elsewhere:

> "V.P. Demikhov told us about his experimental plastic operations on coronary vessels. I always keep abreast of his experimental studies with great interest; they have been also scrutinized by scientists in a number of countries. But I would like to advise him to combine closer his plastic surgery and his experimental observations with clinical ones, to

work in clinic more extensively, because the clinic is wider than the experiment "[2, p. 286-287].

And with those words I.A. Kassirsky shot in the top ten! By the sight of an outside observer, he, in fact, confirmed what V.P. Demikhov was talking about for many years: about implementing the results of his experiments in clinic and the need for cooperation between therapists and surgeons in the management of coronary insufficiency.

But we were interested in another presentation, which was made at the same meeting. It was entitled "The experience of restoring the contractile activity of the human heart after death". And it was made by the Candidate of Medical Sciences Yu.S. Chechulin, an employee of Professor S.V. Andreev's Laboratory in the Institute of Cardiovascular Surgery of the USSR AMS[7]. The speaker told about his experience of the coronary artery bed revitalization using the perfusion with a special "nutritional" solution prepared of 157 isolated human hearts taken from embryos and corpses of humans aged from 28 weeks to 83 years at 3 hours 40 minutes to 65 hours 50 minutes from the moment of death. The cardiac activity was observed to restore in 54 hearts (34.3%).

It was also found that the restoration of the myocardium contractility was possible within up to 40 hours after death and that the hearts of embryos and children under 5 years of age had the greatest ability to restore their activity.

Further, the author analyzed in detail the ability of the heart to restore, depending on the disease that led to death; and he demonstrated a direct correlation between the rates and extent of myocardial revival and the

[7] On November 17, 1960, when the presentation was made, the Institute was called the Institute of Thoracic Surgery of the USSR Academy of Medical Sciences, but the Session Proceedings were published only in 1964, after the Institute had changed its name.

amount of nutritional fluid entering the coronary arteries per unit of time. Thus, the author indirectly confirmed the rightness of V.P. Demikhov regarding the need to restore a full-value myocardial perfusion in coronary insufficiency; however, he linked the failure of contractile activity restoration to the baseline, *functional* and structural, myocardial condition in patients with hypertension, myocardial infarction, angina and "increased predisposition of the coronary arteries to spasms". Despite the fact that his speech did not directly correspond to the topic of the second day of the Session, it nevertheless showed that, first, V.P.Demikhov was not the only one who worked at organ revitalization; it was also under way at the Institute of Thoracic Surgery (though performed by physiologists, rather than surgeons), and second, that A.A. Kulyabko's life-work "lived and won": the same as at the beginning of the century, the concept of reviving a corpse with functional recovery of the organs that could later be used for transplantation, was quite substantial. It was something that V.P.Demikhov tried to promote. Incidentally, we should note that he refused from his initial idea to transplant *working organs.* Or he was made to abandon it.

(To be continued)

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