

HISTORY OF HAND SURGERY IN RUSSIA.

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Despite the fact that there are plenty of articles, academic papers and dissertations which are dedicated to problems connected with hand surgery, there is no such separate specialty in Russia – “hand surgeon” as there are no examinations or standards of care for such patients.

This article represents main periods of hand surgery development in Russia. It also reflects main achievements of Russian surgeons, their contributions to hand surgery development and their main written works and proposed methods of surgical treatment.

**Key words:** history of medicine, traumatology, hand surgery, hand conditions, tendon repair technique, skin grafting technique, hand group.

## INTRODUCTION

Hand surgery is the part of surgery which is dedicated to solving problems connected with diagnosis and management of upper limb traumas. This field of medicine has its own rich history of development. At present time we can observe sensible differences in approach to organization of hand surgery service in Europe and Russia. In the middle of XX century in the USA hand surgery is step by step parting from trauma and orthopedics and is being developed as separate specialty mostly due to Sterling Bunnell (1882 – 1957). Also by that time American society for hand surgeons is being formed and lots of hand surgery centers are being opened [5]. At the same time for Russian doctors this part of trauma and orthopedics is still just an area of interest. The situation is also becoming complicated due to lack of access to foreign literature and to clinical studies of leading specialists and to their projects.

At present time there are no standards of care, certification nor professional criteria of hand surgeon in our country. Medical treatment for hand surgery patients is provided by trauma orthopedists or plastic surgeons, who are interested in reconstructive surgery of the upper limb. Furthermore the approach to treatment

differs between aforementioned groups of specialists [2]. Debates on creating separate specialty continue till the present days.

## **FORMATION PERIOD**

Hand surgery in the XIX century in Russian Empire did not exist as a separate specialty or a part of surgery. Mostly it can be explained by presence of schools for general surgeons. During that period we talk about important impact of separate individuals who formed a basis of such specialties as trauma and plastic surgery within which hand surgery is being developed nowadays.

Surgeon of eminence, anatomist and teacher Nikolay Ivanovich Pirogov (fig. 1) (1810 – 1881) was the pioneer for development of basis of trauma and plastic surgery.



One of the first schools which was connected with first steps to this area of interests was University of Dorpat in Dorpat, Governorate of Livonia (now it is situated on the territory of Estonia, Tartu). Particularly this university became alma mater for young doctor and teacher N. I. Pirogov. After obtaining the diploma of the medical faculty of University of Moscow and several years of study abroad Nikolay Ivanovich was getting ready for professorial work in the Professorial institute by the University of Dorpat. There in the operative clinic Pirogov had been working for several years, then brilliantly completed his dissertation and was elected for becoming professor at the age of twenty-six. Soon after completing his dissertation and approval for the position of professor he had to leave the home ground. But after finishing his education in University of Moscow and gaining clinical practice in the University of Dorpat this outstanding scientist continued his hard-fought professional life. He became the main surgeon of Sevastopol during Crimean war during which he invented absolutely new methods of treatment for wounded soldiers (division the wounded according to trauma severity level), tactics of saving treatment for wounded hands and methods of skin-bone grafting. Beyond that he was first to apply immobilization with a plaster cast in 1852, and this method led to extension of indications for performing of preserving surgeries and reducing the amount of radical amputations including the upper limb area. This plaster cast is used nowadays almost in the unchanged manner (fig. 2).



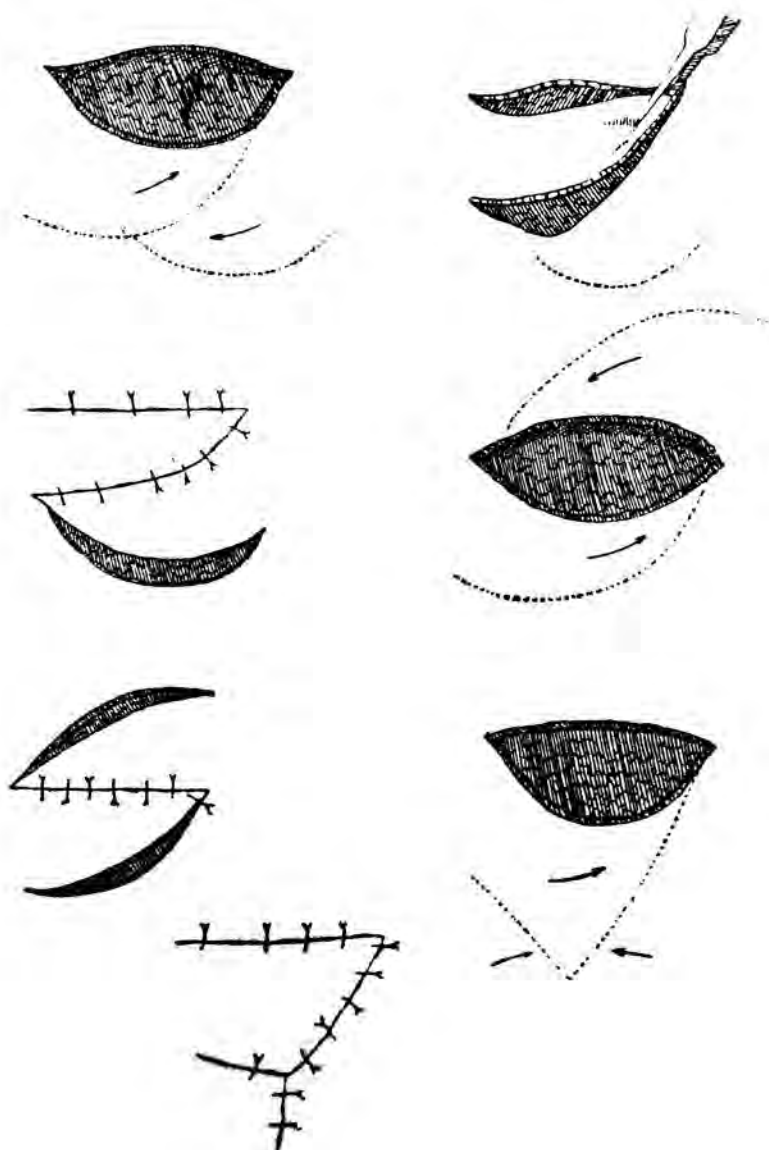
Scientific heritage of N.I. Pirogov was not limited only to surgery. His works such as “Complete course of applied anatomy of the human body” (1843-1844) and «Topographic anatomy illustrated by cuts made in three directions across a frozen human body» (vol. 1-4, 1851-1854) became famous far from the borders of our country and predicted the development of «surgical» anatomy for many years to come. It was N.I. Pirogov who invented the term «extensor apparatus of hand» [10]; spatium cellulosum between third and fourth layers of muscles in the distal third of forearm also has the name of Pirogov as the venous angle formed by the inner jugular and subclavicular veins; amygdalas forming the lymphoid ring of pharynx; operative techniques of femur amputation and

osteoplastic amputation of lower leg; lots of streets in different cities of Russia, scientific communities and medical universities bear the name of Pirogov.

At the same time Juliy Karlovich Shimanovskiy (fig. 3) (1829-1868) – follower and contemporary of N.I. Pirogov, graduate of University of Dorpat (where earlier Pirogov was approved as professor) became the founder of plastic surgery.



In 1865 in monography “Surgeries on the surface of human body” (fig. 4) he united experience of surgeons from different countries, systematized and described more than 600 schemes of surgeries, 60 of which were authorial. He proposed the method for extension of the skin in the amputation stump, invented lots of original methods for wound closing for wounds of different forms (rectangular, triangle, round, rhomboid, elliptical defects etc.) where he applied so-called “transpositional flaps”. And even nowadays its elements did not fail their crucial and practical importance in closing of skin defects present in hand traumas (fig. 5) [11].



Unfortunately no-one will ever know how big could be the impact of this prominent surgeon. Juliy Karlovich died at the age of 39 due to severe oncological disease; surgeries performed by N.I. Pirogov and V.A. Karavayev did not provide the desired results.

Son of one of the famous architects of Saint-Petersburg – Fedor Boguslavovich Gendenreich, surgeon, who in his monograph “Gunshot wounds of hand and fingers” (1880) united the experience gained during Russo-Turkish War (1877-1878) becomes barely visible figure. He gave detailed description for range of operative treatment and rehabilitation after hand traumas, which were prevailing during the war at that time. Also he was one of the first doctors who started to study the effectiveness of antiseptics (iodoform) in the military surgery and methods of disinfection of surgical instruments [4].

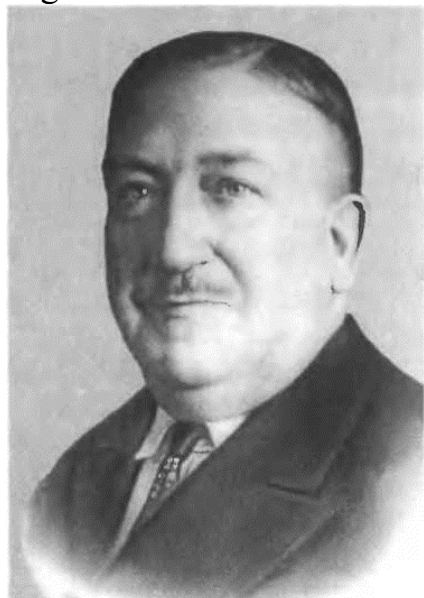
The beginning of XX century became the new epoch in the field of general surgery practice. By that time more attention was paid for surgical treatment of conditions of musculoskeletal system, most of which were congenital. It led to formation of first scientific schools of orthopedics and afterwards – to formation of large scientific centers and institutes.

Thus under the leadership of most influential surgeon and trauma orthopedist Genrikch Ivanovich Turner (fig. 6) (1858-1941) on the base of Military Medical Academy in Petersburg department of desmurgy and mechanurgy (where Turner was the head of the department) was transformed into department of orthopedics (first in the history of Russia, 1990).



Genrikch Ivanovich paid much attention to children with congenital pathology of musculoskeletal system: in 1882 he participated in creating the shelter for children with congenital deformities, in 1932 this shelter was transformed into the Turner scientific research institute for children's orthopedics [12].

In 1906 still in Petersburg prominent orthopedic surgeon of that time Karl Christianovich Horn (1851-1905) initiated the creation of Russian university of orthopedics, where he was meant to become a director. But his sudden death forced to choose another candidate – Roman Romanovich Vreden, surgeon (fig. 7) (1867 – 1934), who has recently came back from Russo-Japanese war, where he was the main surgeon of Manchurian armies.





He was an excellent candidate due to huge war experience, brilliant surgical training and administrative abilities. R.R. Vreden was the active participant in practical work, performed most complex surgeries and organized scientific societies; he is rightfully considered one of the founders of operative orthopedics in Russia [12].

Thus, scientific school of I.G. Turner became the basis for further exploration of orthopedic conditions, and school of R.R. Vreden for active surgical treatment of patients with traumas.

Hard times after Civil war and Russian revolution seriously affected the work of Russian university of orthopedics. There was a need in performing of large number of reconstructive surgeries for wounded Red army soldiers. The solution was seen in consolidating Physio-surgical institute and Orthopedic institute in State traumatological institute under the direction of Andrei Lvovich Polenov (1871 – 1947). It is his name which is connected to formation of the first in Russia department of traumatology in 1918 due to the need in traumatological departments and trauma doctors. Also he is connected with traumatology and orthopedics becoming a separate specialty [12].

Simultaneously in 1921 in Moscow famous surgeon, graduate of Imperial university of Tomsk Nikolay Nikolayevich Priorov (fig. 8) (1885 – 1961) together with his teacher Vladimir Nikolayevich Rozanov (1872 – 1934) founded Medical prosthetic institute, which was meant to provide wounded soldiers with prostheses.



Till the end of his life N.N. Priorov was the director of this institute, which later became Central institute of traumatology and orthopedics (CITO). He organized 17 more centers all across the country, and also he himself was very interested in reconstructive surgery and trauma [12].

Unfortunately the fact that trauma and orthopedics came out from general surgical practice did not lead to full development of hand surgery as the traumas of vessels, nerves and soft tissues skin defects were not the area of interest of trauma doctors. These questions were still actual for general surgeons.

As the result of two World wars, Civil war, local conflicts in 1920s – 1940s there was huge amount of wounded and disabled people. Exactly at that time surgeons had to perform much more reconstructive and organ-preserving surgeries on different parts of human body, organs and systems than during time of peace. Mostly it was connected with fire arms development and consequently expansion of its destructive ability.

Thus in the very middle of the Great patriotic war one of the leading professionals in the field of plastic and reconstructive surgery, professor of Perm medical university Boris Vasilyevich Parin (fig. 9) (1904 – 1968) proposed wide introduction of methods of reconstructive surgery to the routine practice and formation of network of specialized departments and hospitals of reconstructive surgery.



The results were obtained in the nearest future: number of amputations and disablements after was traumas was meaningfully reduced. B.V. Parin himself first proposed methods of defect plasty with perforated graft (1939) and full-thickness skin graft (1941), which were widely applied for defect closing on the upper limb. Also he invented modifications of phalangization if metacarpal bones (first and second methods), forearm kineplasty together with Vadim Vladimirovich Azolov (1937 – 2013) (closing of the interdigitalis space base with tongue-shaped rotation



flap from the palmar side of the forearm) [1]. In general Boris Vasilyevich proposed more than 20 new surgical methods in urology, thoracic surgery, plastic and reconstruction surgery; he made more than 200 reports on different conferences, sessions and congresses in our country and abroad. 26 of his students were directors of departments in universities, large departments in different institutes. Now therefore we can say that B.V. Parin created his own surgical school in Perm [3].

Prominent scientist, anatomist and graduate and later professor of Kuban medical university, surgeon Vladimir Konstantinovich Krasovitev (fig. 10) (1904 – 1993) was also interested in skin defects grafting. It is worth noting that he was very versatile surgeon and was working on cardiovascular, thoracic, abdominal surgery, orthopedics of major joints.



By 1930s he collected all his data and proposed method of primary free flap plasty with rejected or dissected flaps or so-called «garbage skin» [9]. Principle of this method included the fact that flap edges after traumatic rupture were flayed, then subcutaneous fat was cut off, flap was washed with soap, epidermis was treated with iodine. Later even if failed this flap could still function as temporary biological dressing. Krasovitev performed his first surgery of this type on June 26 1935, and he was a year ahead of the Canadian doctor, A. Farmer. Later Krasovitev passed Ph. D. defence on that subject.

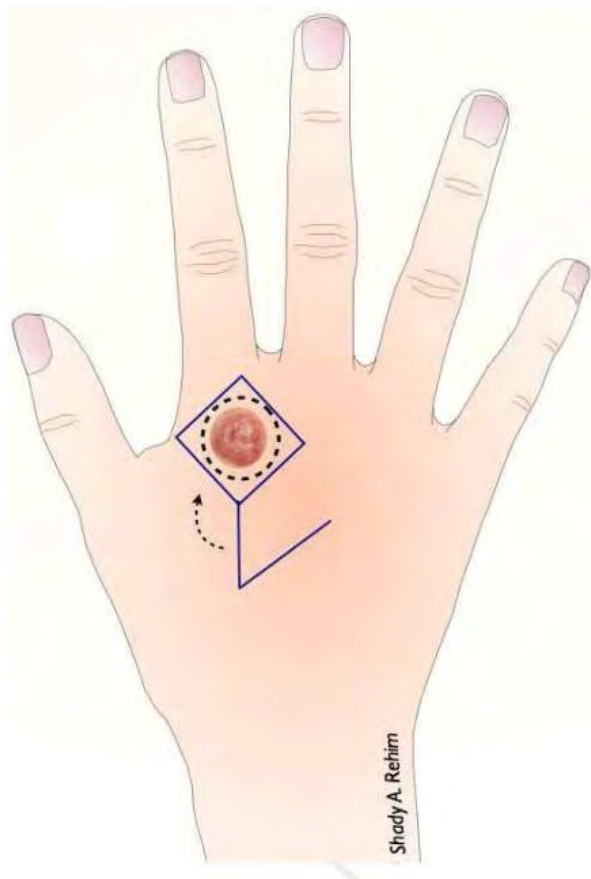
A group of surgeons from Leningrad institute of traumatology and orthopedics (LITO) which later became RSRI of TO n.a. R.R. Vreden was fundamentally interested in local flaps, hand reconstruction and tendon sutures. Among them you can find leading figures and followers of R.R. Vreden such as A.A. Limberg, V.I. Rozov, M.M. Kazakov, V.G. Vainshtein

Prominent oral surgeon, head of department of oral and maxillofacial surgery in LITO Alexander Alexandrovich Limberg (fig. 11) (1894-1974) was also interested in skin grafting.



He was a son of famous stomatologist A.K. Limberg and followed the steps of his father – showed his interest in problems of oral and maxillofacial surgery.

He was the first to publish the idea of «triangular flaps» in 1928 and thus due to clinical observations, experience, collecting literature data (including works of J. K. Shimanovsky), systematization of obtained data created dramatically new approach to planning of plastic surgeries. During the Siege of Leningrad he wrote «Mathematical background of local plasty on the surface of human body» which was published in 1946 and is still popular nowadays. Masterwork «Planning of plastic surgeries in the body surface. Theory and practice» of 1963 included 40-year long work experience of doctors working in department of oral and maxillofacial surgery of Leningrad institute of thaumatology and orthopedics, was translated into many languages and left a mark in international plastic surgery [8]. Limberg flap (fig. 12), different modifications of Z-plasty are nowadays methods of choice to correct the consequences of upper limb traumas [13].



Large influence on further hand surgery development was provided by works of great specialist of national surgery, head of department of reconstructive surgery Veniamin Ivanovich Rozov (fig. 13) (1887 – 1960).



He was a graduate of seminary and decided to continue his study in the medical faculty of Imperial university of Tomsk, which also became alma mater for his fellow student who would later become the founder of CITO N.N. Priorov (later named after him).

Monograph written by V.I. Rozov «Tendon injuries of finger and hand and methods of their treatment» (fig. 14) published in 1952 caused a massive outcry

and is still a «desk book» for trauma and orthopedic surgeons. Guidance written by V.I. Rozov together with his colleague Vladimir Grigirievich Vainshtein (1895 – 1987) in Leningrad «Treatment of injuries in surgical ambulance practice» (1937) had 2 publications and was popular for a long period of time.



V.I. Rozov also proposed: instrument set for tendon grafting (1933) (fig. 15); immobilizer for treatment of closed extensor tendons' injuries (in the area of second interphalangeal joint) (1935); method of surgical treatment of Volkmann's contracture together with Georgy Yakovlevich Epstein (1897 – 1964). Additionally Veniamin Ivanovich was working on tendon grafting, also he improved flexor tendons' suture of M.M. Kazakov, made it «simple and durable» so now it is named suture of «Kazakov-Rozov» [7].

In postwar time doctors paid more precise attention to investigating ethiology, pathogenesis, diagnostics of particular hand conditions and also to developing modern methods of surgical treatment of hand conditions and injuries, which was required by the needs of peacetime.

First in the USSR and second in the world specialized department of microsurgery of hand was opened in CITO in Moscow in 1963, where under the direction of the graduate of medical faculty of Moscow State University, leading trauma orthopedist of Russia Vladimir Nikolaevich Blokhin (fig. 16) (1897 – 1957) and later of his follower Ivan Grigorievich Grishin lots of theoretical studies were made and they also paved the way for introduction of gained results into practical health service.

Many works of V.N. Blokhin were dedicated to problems of pediatric orthopedics (skeletal dysplasia, congenital dislocation of hip, clubfoot), limb prosthetics, supplying of adult patients by orthopedic apparatus supported employment. But most prominently the talent of Vladimir Nikolaevich showed up in plastic surgery. He proposed: improvements in method of formation of Filatov

tubed pedicle, method of closing the skin defect during the Krukenberg surgery, methods of using the titan implants during arthroplasty, method of fixation of fingers of hand during treatment of postburn contractures, technique of formation of actively moving fingers and reconstruction of 4 fingers at once. In 1970 he reported 69 cases of percutaneous fasciotomy for Dupuytren disease (before Lermusiaux). Also he invented the set of items for exercises with fingers on case of their deformities and set of immobilizers for hand and finger fractures [5]. That was the path of Moscow school of trauma orthopedists.

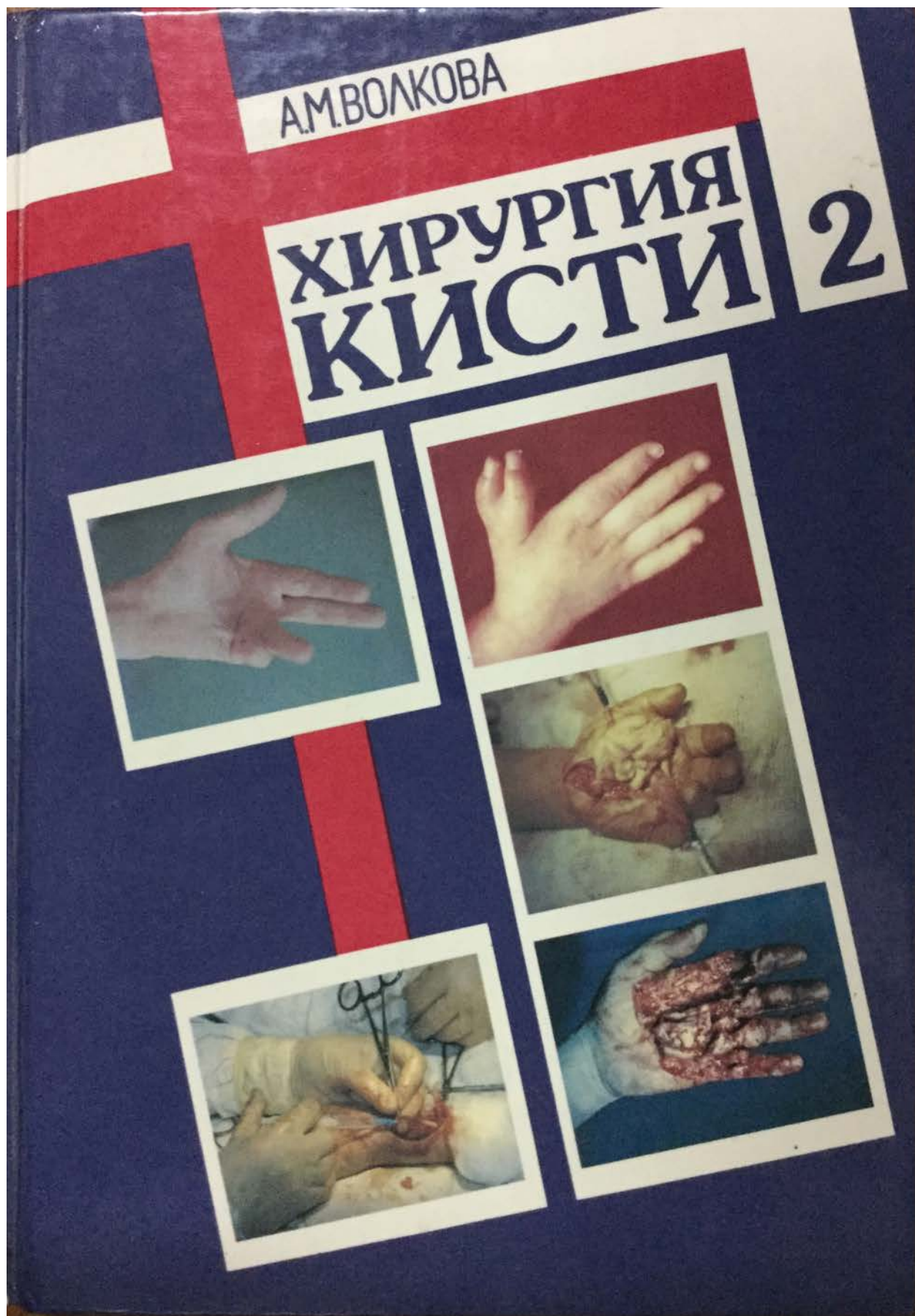
First in Soviet Union municipal hand surgery department was opened in 1969 in City clinical hospital №4 in Moscow. One of the followers of V.N. Blokhin – Aleksandr Aleksandrovich Lazarev was the first head of the department. Later professor Vyacheslav Fedorovich Korshunov became academic director of the department. One of the prospects of department was the invention of the distraction method and its introduction into clinical practice where it was used for treatment of different hand pathologies. For this work in 1987 A.A. Lazarev and V.F. Korshunov together with I.G. Grishin, V.V. Azolov, O.V. Oganessian and O.G. Gudushauri were rewarded by USSR State Award for “invention of methods for hand function recovery with distraction apparatus with transosseous fixation and reconstructive surgeries”.



Alevtina Mikhailovna Volkova (fig. 17) (1929 – 2009) was another «pioneer» of hand surgery development and creator of the Ural school. She was a great scientist, surgeon, brilliant health professional and she took part in development of traumatological and orthopedic service in Sverdlovsk (now



Yekaterinburg), lots of traumatology stations were opened under her patronage. From 1965 till 1967 she was the head of the biggest in the city department of traumatology and orthopedics, later she became the head of the cathedra of traumatology, orthopedics and military surgery of the Medical university of Sverdlovsk for the next 23 years. She was the one to thank for the formation of the system of treatment of patients with recent hand injuries, opening of the specialized hand surgery center in the Ural region [3]. In 1964 A. M. Volkova passed Ph. D. defence on “Reconstruction of flexor tendons of the hand in the area of synovial compartments”, in 1978 – doctoral dissertation “Reconstructive hand surgery for multisystem injuries of tendons and nerves”. Her fundamental three-volume edition “Hand surgery” (fig. 18) is popular among young and experienced doctors even nowadays. A.M. Volkova proposed unique technique of surgeries on flexor tendons, particularly method of transplant fixation to the distal phalanx during tendon grafting, operative approach for tendon grafting; also she trained a lot of scholars and followers.



In 1973 director of All-Soviet union scientific center of surgery Academy of Medical Sciences in USSR in Moscow academician Boris Vasilievich Petrovsky (fig. 19) (1908-2004) after observing results of new microsurgical technologies of

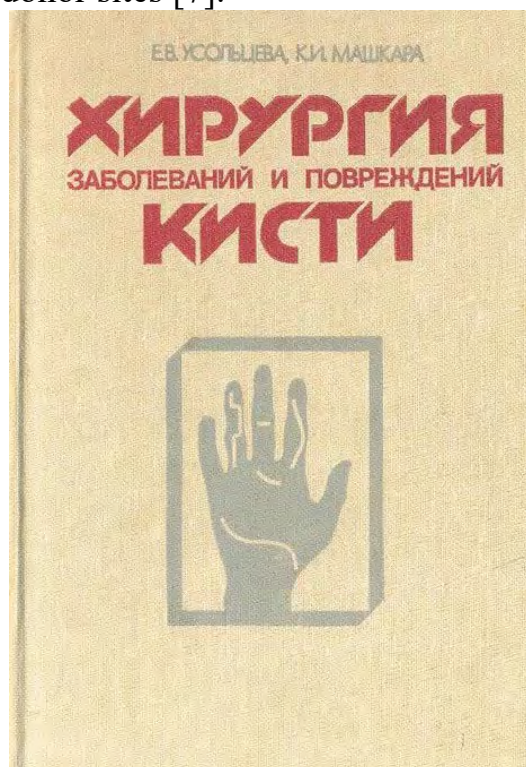
foreign colleagues created scientific experimental group under the direction of Victor Solomonovich Krylov whose members were G.A. Stepanov, R.S. Akchurin, and later T. Peradze, I.Y. Kuzanov, N.O. Milanov, A.M. Borovikov, R. Datiashvili and others [12].



The aim was to create laboratories and to become masters of microsurgical technique for further performing of full range of surgical interventions which were already being performed abroad. City clinical hospital №51 in Moscow was chosen as the base, where 5 and later 20 clinical beds were created. So far already in 1976 doctors performed first in the USSR successful replantation of the thumb, during the same year they performed first replantation of the hand; in two years time – replantation of both hands, and in 1981 – replantation of the shoulder. In 1983 whole USSR was shocked by the history of girl from Lithuania who had lost both feet as the result of home accident. It was the first time when doctors performed successful replantation of both feet. City clinical hospital №51 was the example for new similar departments in Russia which were opened later and divided into emergency and non-emergency departments. In 1987 department of emergency microsurgery under the direction of G.A. Stepanov was moved from City clinical hospital №51 to City clinical hospital №71, where it is situated at present time and continues its development in the field of microsurgery.

In 1984 Gavriil Abramovich Ilizarov and his colleagues invented new apparatus to perform osteosynthesis of tubular bones of the hand [1]. Upon his initiative first department of hand and foot pathology was opened in Research institute of experimental and clinical thaumatology and orthopedics of Kurgan. Later on January 1 in 2004 it was transformed into two separate departments – department of hand pathology and department of foot pathology. Nowadays monolateral apparatus of external fixation of short tubular bones is widely used. This apparatus is used for treatment of both acute hand trauma and congenital or acquired diseases. Because of its small injury rate, small size and high efficacy this apparatus is also used to treat children at the age of 1 year and older. In Ilizarov's clinic mini fixator is used to treat bone fractures of hand including intraarticular fractures because it allows to reduce all types of fragments' dislocation [2, 3], posttraumatic deformities of bones of the hand [4]. In orthopedics this apparatus helps to solve the problem of elongation of finger stumps, bones in cases of brachy- and ectodactylia and brachymetacarpia without bone grafts using just the

resources of bone regeneration potential which is explained by the positive influence of bone fragments distraction on osteogenesis [5, 6]. Treatment of patients with different forms of syndactyly is also performed with Ilizarov apparatus. In this case apparatus helps to create extra amount of soft tissues in interdigitalis space which allows to avoid skin grafting with transplants taken from other donor sites [7].



Guidance «Surgery of hand conditions and injuries» (fig. 20) edited by Elena Vasilievna Usol'ceva and Klavdia Ivanovna Mashkara published in 1978 was popular among specialist for a long time as it included anatomy of the hand, united experience of authors in treatment of traumatic, inflammatory and tumor conditions of the wrist apparatus, discussion of mistakes and consequences of different treatment methods. “Emergency surgery of open injuries of the hand and fingers” (fig. 21) written by apprentice of B.V. Parin, trauma orthopedist Zinaida Fedorovna Nel’zina, was not less popular.





It included discussion of the questions of primary skin grafting in cases of hand and finger injuries; primary osteosynthesis; indications for primary tendon and nerve sutures in case of emergency treatment in hospital; rehabilitation of patients after surgeries; also the author proposed and patented method of grafting technique in case of circular skin defects of fingers and discussed surgical tactics in different clinical cases.

## **PRESENT-DAY STATE OF HAND SURGERY IN XXI CENTURY**

In 2003 in Yaroslavl foundation conference «Russian hand surgery society – hand group» was held (fig. 22).



It led to formation of the first structure in history of the country which addressed the issues of hand surgery. Chairman of the management board was Ph. D. I.O. Golubev. In 2006 on the I congress of hand surgery society of Russia, which was held in Yaroslavl on 20-22 april he was chosen to be the chairman for the second time. In addition till present time I.O. Golubev is a Russian delegate in Federation of European Societies for Surgery of the Hand (FESSH) (fig. 23) and also – the chairman of accreditation committee of hand trauma.





Later congresses of “Hand group” were held in Saint-Petersburg (2008), Moscow (2010), Tomsk (2012), Kazan (2014), Nizhniy Novgorod (2016) and the last one was held in 2018 in Yekaterinburg. Participants of these forums permanently mention high scientific level of reports and good organization of each congress.

By the end of 2016 there were 4 certified centers of European Societies for Surgery of the Hand in Russia: microsurgery department of City clinical hospital 71 n.a. M.E. Zhadkevich (Moscow); microsurgery department of RSRI of TO n.a. R.R. Vreden (Saint-Petersburg); Research institute of microsurgery (Tomsk); City clinical hospital n.a. N.V. Soloviev (Yaroslavl) [6].

In 2012 in Tomsk a guidance “Essay if clinical anatomy of the hand” (fig. 24) edited by V.F. Baitinger and I.O. Golubev and “Hand book of hand surgeon” (fig. 25) edited by V.F. Baitinger and D.N. Sinichev were first of their kind and became a great helping hand in practical work for doctors who are interested on hand surgery problems.





These books include the necessary information including hand anatomy; laws and regulations for hand surgery; rating scales for long-term treatment results; also they contain description of different symptoms; unified terminology and ICD codes for upper limb conditions. Publication of these guidances is the first step towards development and growth of hand surgery as a separate specialty.

Evaluation of publications, dissertations of Russian specialists in hand surgery made for the last 15 years lets us draw a conclusion that they were dedicated to following problems: treatment of deformities and malformations; treatment of fractures and non-unions of scaphoid bone; management of large posttraumatic defects; pollicization performed with microsurgical technique; recovery after injuries; injuries and instability of wrist. From the beginning of XXI century we can note annual increase of amount of articles and dissertations dedicated to hand surgery problems.

## **CONCLUSION**

Despite a high level of medicine in general and surgery in particular in Russia there are still organizational difficulties for separating hand surgery as a different specialty which are connected with absence of treatment standards, regulatory framework for accreditation and examination of such specialists, educational programs and programs of professional retraining. Introduction of this specialty will allow to coordinate the work of doctors – hand surgeons; to create

conditions for further training and improvement of quality of health care within the accepted standards.

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