Reformer in Traumatology and Orthopedics (to centenary of G.A.Ilizarov)

Abdulkhabirov Magomed Abdulkhabirjvich
Associate Professor
Medical Institute
RUDN University, Moscow

Abstract. The article analyzes the unique personality of the XX century, the outstanding Soviet orthopedic surgeon-Gavriil Abramovich Ilizarov. The evolutionary process of the formation and development of the Ilizarov method in traumatology and orthopedics at the domestic and world level is shown. The undeniable advantages of the external fixation system developed by Ilizarov are revealed. The design of the Ilizarov compression-distraction apparatus is considered. Being familiar with G.A. Ilizarov, the author shares his memories about him, describes the biological and mechanical features of the influence on the bone and other tissues of the Ilizarov system, which has become a classic and internationally recognized in the treatment of patients with fractures, pathological conditions of the musculoskeletal system, congenital and post-traumatic orthopedic deformities of the limbs.

Keywords: Gavriil Ilizarov, osteogenesis, traumatology, orthopedics, distraction, Ilizarov apparatus, bone elongation.

Formulation of the problem. The Ilizarov method of lengthening, reconstruction and osteosynthesis of bones has received tremendous development since its introduction by G.A. Ilizarov in the Soviet Union in the 1960s and Western countries in the early 1980s. The Ilizarov method has become an integral part of the arsenal used by the orthopedic community around the world, whose evolutionary development and its current role have significantly improved the quality of life of millions of people. Despite the great versatility of its possible applications for bone injuries and diseases, the Ilizarov method cannot be an alternative to a number of other methods used for some specific bone conditions. Gavriil Ilizarov himself warned not to consider his system unified. The research problem is due to the lack of a comprehensive comprehensive analysis of the unique methodology of the Soviet doctor Gavriil Abramovich Ilizarov in the

context of a retrospective analysis of his method in orthopedics and traumatology in order to determine promising directions for further scientific research in this area, taking into account the personal acquaintance of the author of the article, focused primarily on the implementation and practical use in clinical work.

Analysis of recent research and publications. Issues related to the personality of the great doctor Ilizarov, as well as modern experimental studies regarding the use of the method of distraction osteogenesis (Ilizarov's method) were highlighted in the works of Russian (A.Ya. Adsmadi, E.I. Solod, M.A. Ivashkin, A. A. Artemiev, A. M. Koshub [1], A. V. Gubin, D. Yu. Borzunov, T. A. Malkova [3], E. I. Ilizarova-Abaeva [4], E.A. Melikov, A.Yu.Drobyshev, IA Klipa, S.A. Snigerev, S.V. Shamrin [5],) and foreign researchers (J.G. Birch, M.L. Samchukov [6], M. Bisaccia, C. Ibáñez [7], J.J. Jr. Gugenheim [11], D. Lowenberg, M. Githens [12], etc).

So, according to J.G. Birch, M.L. Samchukov, the introduction in the West in the early 1980s of the circular external fixator and the Ilizarov method led to rapid progress in limb lengthening, deformity correction, and reconstruction of segmental long bone defects [6]. Mechanical features and biological response to the use of distraction osteogenesis with a circular external fixator are unique aspects of G.A. Ilizarov. In experimental studies conducted by J.G. Birch, M. L. Samchukov, as well as the experiments of D. Lowenberg, M. Githens, the most common indications for children and adolescents are limb lengthening and angular deformity correction [6; 12]. Indeed, the surgical application and postoperative management of the Ilizarov apparatus requires meticulous attention to detail by both the patient and the surgeon. In addition, a thorough understanding of the basic principles of the Ilizarov apparatus, mechanical axial adjustment, potential complications and the biological response to stretching is required from the surgeon.

J.J. Jr. Gugenheim substantiates that the Ilizarov method is widely used for the formation of bone and soft tissue using an external fixator, consisting of small pins, tension wires, rings, hinges and distractors [12]. The success of the technique, as the author rightly claims, depends on the observance of the principles of the Ilizarov "stress-strain" phenomenon: preservation of blood supply to tissues, frequent distraction with small increments, and full-fledged function of the limb.

Isolation of previously unresolved parts of a common problem. Despite Ilizarov's international recognition, including the creation of the Association for the Study and Application of Ilizarov's Methods, the invitation of Gavriil Abramovich to international symposia, conferences, opposition and skepticism from the Moscow medical establishment continued until the last years of Ilizarov's life, limiting the great doctor in many titles and awards, including

yourself the opportunity to be a member of the Academy of Medical Sciences of the USSR, awarded the Nobel Prize, etc.

The purpose of the article is to review the Ilizarov method and its undeniable advantages in modern surgery in the treatment of various pathological conditions of the musculoskeletal system.

Presentation of the main material.

Gavriil Abramovich Ilizarov - Soviet physician, Doctor of Medical Sciences, Professor, Academician of the Russian Academy of Sciences, Hero of Socialist Labor, Honored Inventor of the USSR, famous for the invention of the Ilizarov apparatus for lengthening limb bones and the method of surgery named in his honor by Ilizarov surgery.

G.A. Ilizarov was born on June 15, 1921 as the eldest of six children into a poor Jewish family in Bialowieza (Polesie Voivodeship, Poland). Soon after his birth, the family moved to his father's parents in the city of Gusar (Azerbaijan). His father, Abram Ilizarov, was a Mountain Jew from Gusar, and his mother, Golda Rosenblum, was a Jew of Ashkenazi origin.

G.A. Ilizarov graduated from the Buinaksk Medical Rabfak (an educational institution created to prepare workers and peasants for higher education). In 1939 he entered the Crimean Medical School of Simferopol. After the outbreak of the Great Patriotic War in 1941, the school was evacuated to Kyzylorda in Kazakhstan. After leaving school in 1944 G.I. Ilizarov was admitted to a rural hospital in Dolgovka, Kurgan Oblast in Siberia, 2,000 kilometers east of Moscow. In 1950, Ilizarov received a position in the department of the Kurgan Regional Clinical Hospital as an air ambulance surgeon. In 1955 he became the head of the department of traumatology and orthopedics of the Kurgan regional hospital for war veterans.

Residency training and Ilizarov's unique experiments.

Ilizarov's residency was in orthopedic surgery, during which he developed a system of external fixation (1951). Gavriil Abramovich found that by carefully cutting off the bone without tearing the periosteum around it, you can slightly separate the two halves of the bone and fix them in place, and the bone will grow, filling the gap that has formed. At the same time, G.A. Ilizarov found that bone grows back at a fairly uniform rate in different people and circumstances.

These experiments led to the creation of the so-called Ilizarov apparatus, which holds the bone torn in this way in place thanks to the skeleton and pins passing through the bone, and separates the halves of the bone by a tiny amount; by repeating this over time at the rate of bone growth, the bone can be lengthened as much as desired. This procedure was inspired by the horse-drawn carriage archery harness. Originally, bicycle parts were used for the frame.

The reason for the creation of the external fixation system was the stay in the village. Dolgovka, where Ilizarov faced a huge number of pathologies, but had the minimum amount of technologies available to him. Open fractures often resulted in septic non-union. Chronic pain, drainage and bone destruction with shortening of the limbs were common. In turn, Ilizarov used sterile bicycle spokes attached to pieces of metal as external fixation for these septic non-joints. Through clinical experience and laboratory experiments on animals, he found that he could eliminate infection and heal through the gradual, controlled manipulation of the device. Most importantly, no antibiotics or bone grafting were required.

Later G.A. Ilizarov tried to correct the inequality in the length of the limbs. During his research, he found that he could create an osteotomy in a long bone, distract the ends with a retainer, and form new bone in a slowly widening distraction gap. Creating the right environment and technique for this to happen reliably and reproducibly took years of critical experimental and clinical research.

Simply put, if tissues are stretched in a certain way, they lengthen or grow without the need for transplantation. This process of distraction histiogenesis depends on adequate vascularization and functional use of the limb. This is a clear departure from the previous concepts of lengthening and correction of limb deformities. When this principle is used in conjunction with the Ilizarov External Circular Fixator in properly planned and guided surgery, the potential for managing bone and soft tissue problems in the extreme extremities is enormous. In the Soviet Union, the Ilizarov method is essentially a field of medicine, parallel to, but different from, Western orthopedics.

For a long time, Ilizarov faced skepticism, resistance and political intrigue from the Moscow medical establishment, which tried to defame him by calling him a "charlatan." However, the steadily growing statistics of successful treatment of patients led to an increase in Ilizarov's fame throughout the country. He became known among his patients as the "mage of the Kurgan". In 1968 G.A. Ilizarov defended his doctoral dissertation in Perm and was awarded the title of Doctor of Science, bypassing the degree of Candidate of Science, for which the dissertation was originally prepared.

The breakthrough came in 1968, when Ilizarov successfully operated on Valery Nikolaevich Brumel, the 1964 Olympic champion and long-term world record holder in men's high jump, who injured his right leg in a motorcycle accident. Before coming to Ilizarov V.N. Brumel spent about three years unsuccessfully treated in various clinics and underwent seven invasive and 25 non-invasive operations.

The confrontation between the Moscow medical establishment continued until the last years of Ilizarov's life. Back in 1991, just a year before his death, Ilizarov was elected a full

member of the Russian Academy of Sciences. Despite numerous awards and worldwide recognition, he was not elected to the Academy of Medical Sciences of the USSR.

Ilizarov's international recognition. The method, developed in 1951 by Professor of the Soviet Union Gavriil Ilizarov, represents an unexpected breakthrough in the treatment of most pathological conditions of the musculoskeletal system by using a complex external fixator, creating an osteotomy and gradually and controlled manipulation of the structure in order to form new tissue.

The most notable application of the Ilizarov apparatus is the inequality of the length of the limbs, it is also used to treat fractures, non-adhesions, arthritis and multiplanar deformities of the limbs. In the Western world, the management of these states has traditionally been based on principles and methods, which in many cases were very different from those advocated by Ilizarov [13].

External fixation for the treatment of fractures complicated by significant soft tissue trauma dates back to Hippocrates. In 1905, A. Codivilla from Bologna published the first report on surgical limb lengthening in the English literature [8]. Since then, due to limited success and high complication rates, there have been many attempts to improve methods and devices for limb lengthening. Since the early 1970s, the Wagner method has become the most popular limb lengthening procedure in the West. In 1963, Professor Heinz Wagner from West Germany developed a one-sided external anchor consisting of two large threaded pins (5 mm in diameter) that are inserted perpendicularly into both the proximal and distal ends of the bone [17]. The pins are connected to a telescopic rectangular bar. An open osteotomy is performed with an oscillating power saw or by connecting multiple drills to an osteotome. The osteotomy is immediately detached by 1 cm and the device is fixed. The next day and each subsequent day, the handle at the end of the device is rotated one full turn, creating 1 mm distraction of the bone segments. Due to insufficient strength and stability of the cantilever system, the weight of the bearing is not allowed. When the desired length has been reached, a second anesthetic is required for covering and bone grafting of the lengthening gap. This is done through a long incision. Bearing weight is still not allowed. A third anesthetic is needed to remove the apparatus when the bone is already hard.

The main disadvantages of the Wagner method include the need for three anesthetics, several months of weightlessness, accompanying osteopenia of the entire limb, and long unsightly scars [16]. In every clinical review of Wagner's limb lengthening, the complication rate was also high and the ability to achieve the desired amount of lengthening was low. Nevertheless, the Wagner method was better than its predecessors. The reports of the very successful Soviet method of lengthening the limbs without complications that appeared in the

early 1980s met with some skepticism in the West. It was even more difficult to accept the fact that it was developed in 1951, 20 years before Wagner's method.

Scattered reports appeared in the Western press about the successful treatment of Brumel by Ilizarov. The first foreign medical visitor was Dr. Johannes Hellinger from the former GDR (German Democratic Republic), Erfurt Medical Academy in 1970. He made the first publication in a Western medical journal on the Ilizarov method. In 1980, during the Cold War era, Carlo Mauri, an Italian mountaineer, explorer and photojournalist, at the insistence of his Russian colleague Yuri Senkevich, traveled to Kurgan, in the Soviet Union. He had to be treated by Ilizarov for a fractured tibia, which healed improperly after a ski accident ten years ago. Italian doctors have long given up hope of any surgical improvement in the leg. Ilizarov distracted the frozen non-union in the tibia by 2 cm, cured pseudarthrosis, corrected the equinus deformity with distraction and lengthened the leg. In turn, K. Maury christened Ilizarov "Michelangelo of Orthopedics". On his return to Italy, the healing of Mauri's leg amazed the orthopedic surgeons. Thereafter, Antonio Bianchi-Maiocchi and Roberto Cattaneo invited Ilizarov to speak as a guest speaker at the AO Italy conference in 1981 in Bellagio. Thus, Ilizarov gave three lectures at conferences to more than 200 participants from Italy, France, Switzerland, Austria and Germany. At the end of the lectures, Ilizarov deserved a ten-minute standing ovation. This was the first time Ilizarov spoke outside the Iron Curtain.

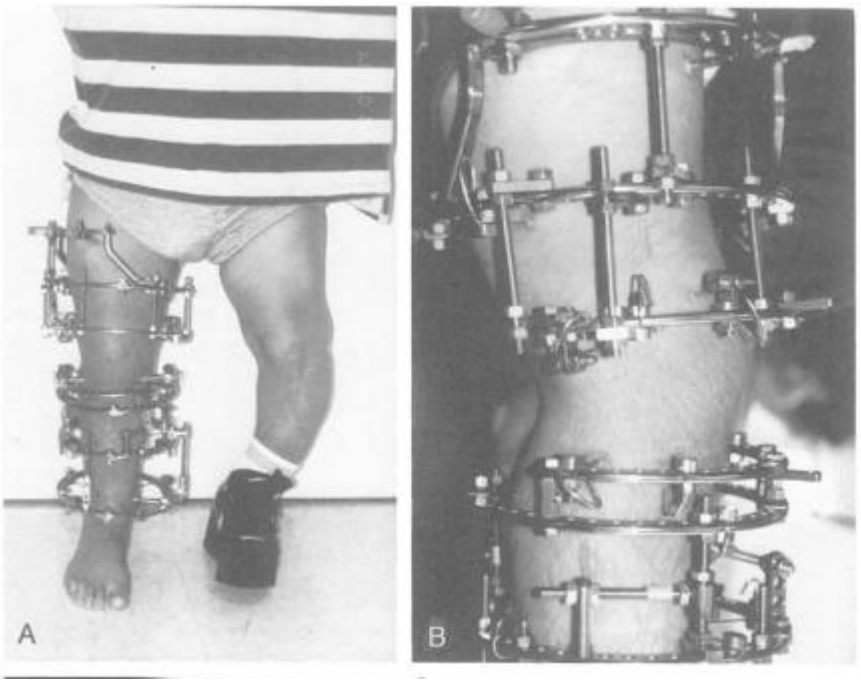
In 1982, the Association for the Study and Application of the Methods of Ilizarov (ASAMI) was formed in Italy. In 1983, the Medicalplastic company, owned by Bianchi-Maiocchi, licensed the equipment from the Soviet authorities, registered the ILIZAROV trademark and began to manufacture and sell the Ilizarov apparatus. In the following years, the Ilizarov method quickly spread throughout most of Western Europe. ASAMI has organized courses in Italy, Portugal, Switzerland, France, Spain, Greece, Brazil and the United States. ASAMI groups were formed in France, Spain, Belgium, Portugal and Brazil.

In 1986-1987, the method was brought to North America by Viktor Frenkel, President of the Joint Disease Hospital, Dror Paley, Alfred D. Grant and Stuart Green, who edited the first English translation of Ilizarov's book in 1992. More than 300 American orthopedic surgeons took part in an international symposium organized in 1987 in New York by the Joint Disease Hospital and Smith & Nephew to listen to Ilizarov's lectures. Smith & Nephew began distributing the Ilizarov external fixator in the United States and around the world [2].

In 1989, Dietmar Voltaire organized the Ilizar Conference in Hamburg. In 1990, Ilizarov came to the second conference in Hamburg, where he became one of the founders of the German Ilizarov Society (Deutsche Ilisarow-Gesellschaft). The hospital of the German Association for Accident Prevention and Insurance (Berufsgenossenschaftliches Unfallkrankenhaus, BGUK) in

Boberg, Hamburg, has become a major center in Germany applying and promoting the Ilizarov method. A visit to the Kurgan center for the study of the Ilizarov method has become mandatory for all senior doctors of the hospital.

The design of the Ilizarov apparatus. The Ilizarov apparatus (fig. 1), includes a circular external fixator, consists of thin wires (1.5 mm and 1.8 mm in diameter) drilled through the transosseous bone and fixed at both ends with bolts and nuts under high tension (from 90 up to 130 kg) to stainless steel rings. Two to four wires and one to two rings are required both proximal and distal to the site of elongation or deformation. The rings are connected by three or four threaded rods located around the circumference. By turning the nuts on the rods, the rings (and therefore the bone segments) are distracted. The use of rings and crossed wires, rather than a single-sided rod and half-pins, gives the device better control of the bony segments in all planes. This is important in order to be able to support the weight during limb lengthening. This feature allows you to correct other deformities with or without simultaneous lengthening of the limbs.



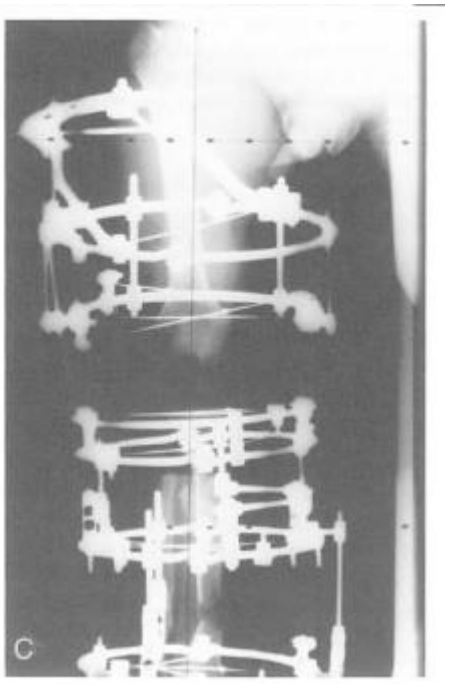


Fig. 1. Ilizarov apparatus
A) The femoral and tibial frames are in place when performing a three-level simultaneous deformity correction;
B) Small incisions for corticotomy are visible;
C) Radiographic appearance during the neutralization phase [13]

Unilateral external anchors can simply hold bones in place or perform unilateral lengthening. The actual placement of the Ilizarov wires and the design of the frame are determined by the individual needs of the patient. The Ilizarov apparatus is, in fact, a "surgical erector" with an almost unlimited number of possible options for the arrangement of components. An important design feature of the Ilizarov apparatus and the reason for the correction of multiplanar deformities is the hinge (fig. 2) - an axis around which two movable parts can rotate in one plane. There are also universal joints that allow you to move between parts in more than one plane. The hinges are simply made from Ilizarov components and are attached to the rings with connecting rods. Special wires called olive wires are used in specific locations when loops are used. A metal ball on a wire rests on the cerebral cortex to prevent the bone from sliding uncontrollably along the wire.

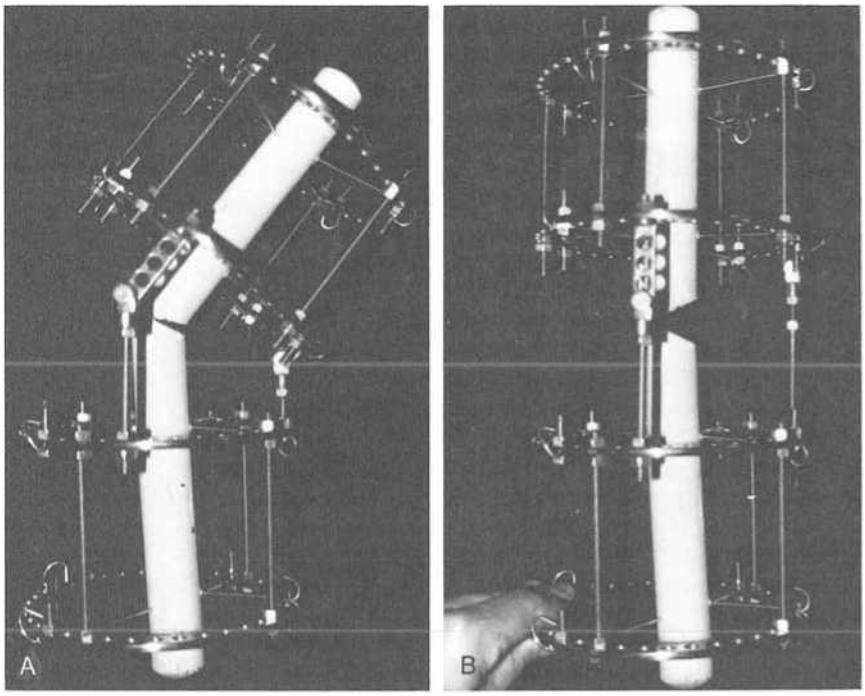


Fig. 2.
A) A simple hinge centered over the convex cortex at the level of the angular deformation. The wires and rings are perpendicular to each bone segment.
C) After corticotomy, distraction of the concave cortex occurs by 0.25 mm every 6 hours. The wires and rings of both segments are parallel at the completion of the deformity correction [13]

During deformity correction, by careful placement of hinges and other components, multi-plane deformations can be corrected simultaneously with lengthening or sequentially without going back to the workroom or adding wires. In the Soviet Union, about 1 million procedures were performed. These numbers include limb lengthening as well as all other applications. The results are impressive. Increasing the length of the limbs is achieved with fewer complications than with the Wagner method, and more versatility for correcting other forms. It should not be denied that complications arise with the Ilizarov method, but the frequency and severity of their occurrence is much lower.

Rehabilitation aspects of the method. G.A. Ilizarov has long recognized the importance of rehabilitation for the success of his method. His research has shown that weight tolerance and physiological use of the limb during treatment are important for the quality and rate of new bone formation, prevention of osteopenia in the entire limb, and maintenance of the functional integrity of soft tissues.

Soft tissues, like bone, undergo lengthening as a result of distraction histiogenesis. Only the bone is rigidly fixed by external fixation devices. Soft tissues are freely threaded and, when lengthened, depend on their bony attachments for tight control. Due to the asymmetric arrangement of muscles around and across the joints, distraction leads to joint contractures and limitation of joint movement, and can also lead to subluxation or dislocation of the joint [10].

Fortunately, these problems can be avoided or minimized with careful attention to rehabilitation. Although Ilizarov reports a very low incidence of pain during lengthening [18], experience in the West shows that patients often have chronic, dull, aching pain during the distraction phase of lengthening, especially with longer lengthenings [14]. The pain increases with physical therapy, walking, and at night. Ilizarov believes that the pain occurs due to improper use of the device or due to an infection of the gastrointestinal tract. Some pain behavior is physiology and some is studied. Even today in Kurgan, drugs, like aspirin, are in short supply. Complaining about pain will not help much to resolve it [9; 13].

The opening of the Ilizarov Center. In 1971, the Kurgan Research Institute of Experimental and Clinical Orthopedics and Traumatology (KRIECOT) was established. The center uses the Ilizarov method of transosseous osteosynthesis to lengthen or change the shape of the limb bones. Ilizarov headed this center until 1991. With about 1000 beds, 24 operating theaters and 168 working doctors, the Center has become the largest orthopedic clinic in the world. After the death of the great orthopedic surgeon, the center was renamed the Russian Ilizarov Scientific Center for Restorative Traumatology and Orthopaedics (RISC RTO).

Over 40 years of work, Ilizarov and his clinical and research associates have published more than 2,000 articles on topics ranging from the biology of distraction histogenesis to reviews of clinical results and technical considerations of the technique. Today the center employs ten professors, 34 doctors of sciences and 193 candidates of sciences. The center includes an outpatient clinic where 250 patients are consulted daily, a hospital with 800 beds, an experimental department and animal surgery. More than 9000 people are treated at RISC RTO every year.

Personal acquaintance of the author with Ilizarov. As a senior researcher at the Center for Household Traumatism of the Central Institute of Traumatology and Orthopedics named after N.N. Priorov in 1980, I was sent for a four-month internship at the Kurgan Research Institute of Clinical and Experimental Traumatology and Orthopedics, where courses were organized at the Department of Advanced Medical Studies on the Ilizarov system of treatment of fractures and deformities. This period became a significant stage in my life, since later I was invited to Turkey (Trabzon. Department of Traumatology and Orthopedics of the Medical Faculty of the Black Sea Technological University) to implement the Ilizarov system. The fact is that Turkey acquired a license to manufacture the Ilizarov apparatus and sold them to many African countries. The design of the device was better than in the USSR, and they designed the spoke tensioner technologically convenient to use. Turkish colleagues showed great interest in the Ilizarov studies and demonstration operations, and the Ilizarov methods gained great popularity in Turkey, although their medicine has long been focused on German.

From personal memories: *In the morning, intensive theoretical and practical classes were held in Kurgan. In the very first days I tried to go to G.A. Ilizarov, but in front of his office every day there was a very large number of patients from different republics of the Soviet Union and even other countries of the world. It was not possible for me to stand this line, skipping classes. Therefore, one day I handed over a note to the secretary G.A. Ilizarov about her desire to meet with him. Soon I was invited to a meeting in the office of the legendary Gavriil Abramovich.*

The meeting lasted more than an hour. Ilizarov gratefully recalled my article on distraction in hand surgery, saying: "I have not yet reached the hand." Upon learning that I was from Dagestan, Gavriil Abramovich became interested in everything that was happening in Dagestan. He said that "without a single ruble from the budget of Dagestan, he will be able to build a Traumatology and Orthopedics Center for the entire North Caucasus on the shores of the Caspian Sea, if Dagestan so desires, because the chairman of the government of the Soviet Union Nikolai Ivanovich Ryzhkov is very respected." On the same day G.A. Ilizarov sent a registered letter to M.M. Magomedov. - to the chairman of the State Council of Dagestan, but I did not receive an answer. I sent the same letter again from Moscow, and again, a strange silence…

At the end of that meeting, I presented Gavriil Abramovich with an Untsukul ink set, which made him very happy. And he gave me a photo with the inscription: "To my native Dagestan and the wonderful multinational people of the country of mountains with love and with the kindest wishes." Later, at a meeting in Moscow, Gavriil Abramovich asked me: "I have been allocated states. Would you like to go with me to Kurgan to head the new department? " I gratefully hugged the great compatriot and stayed to work at CITO, because I had to think not only about myself, but also about my family: my wife, a professor of the medical institute and my daughter, a student of the medical institute. It is not easy to change the familiar to the unknown.

In my opinion, the discovery of the "Biological phenomenon (effect) of Ilizarov" deserves the Nobel Prize, but the communist ideology mistakenly believed that the Lenin Prize (Ilizarov was awarded this prize in 1978) is more prestigious than any (including the Nobel) "capitalist" awards. This postulate of the time put him to be the Nobel Prize laureate and the brilliant designer of spaceships Sergei Pavlovich Korolev, whose jaw was broken by the overseer's boot during the repression, mockery and beating him in the dungeons of the Stalinist Gulag. It is regrettable when politicians, dictators supervise science and command over scientists.

Assist G.A. Many colleagues were afraid of Ilizarov, because Gavriil Abramovich had a habit of sharply, loudly and publicly expressing his dissatisfaction. But I myself impelled myself to assist him, and in the preoperative room, while washing my hands, half-jokingly and half

seriously told him: "Gavriil Abramovich! We are fellow countrymen and therefore must show everyone the culture and friendship of the Dagestanis; therefore, we should not swear at each other in front of others. " Of course, I took a risk, but he was a man with humor, he understood my trick, smiled and we always worked very collegially during the operation.

It is worth saying that Ilizarov operated brilliantly and extremely boldly, but deliberately. He had fantastic volumetric thinking and understanding of the course and outcome of the operation. I especially remember one technique. Gavriil Abramovich had the highest (obsessive) idea: "As long as I live," he reasoned, "I must determine the possibilities and limits of my system." And so Ilizarov undertook to treat the most difficult patients with the most incredible deformities. He even treated the genius composer Dmitry Shostakovich, who wrote a letter to the GS of the CPSU Central Committee L.I. Brezhnev about Gavriil Ilizarov. Then there was a call from the Minister of Health of the USSR, academician B.V. Petrovsky. After that, Gavriil Abramovich was invited to CITO and already M.V. Volkov was forced to publicly give the floor to G.A. Ilizarov. for the performance. The large assembly hall of CITO was overcrowded and the colleagues of the capital listened with admiration for two hours to the speeches of G.A. Ilizarov with the display of X-ray transparencies of patients before and after treatment. This was his historic performance.

G.A. Ilizarov was not an "easy" person. In general, people of genius are not "comfortable, sweet and forgiving." He fired the doctor, who put a plaster cast on his mother with broken ankles on duty and let her go home. Ilizarov rightly believed that in order to use traditional methods of treatment, one should work not in a research institute, but in a city hospital.

G.A. Ilizarov began to develop a treatment for congenital hip dislocation using an apparatus of his own design. This is a very complex pathology. The head of the children's and adolescent department of the Gorkovsky (now the Volga Federal Medical Research Center (VFMRC) in Nizhny Novgorod) of the Research Institute of Traumatology and Orthopedics A.A. Abakarov (Dagestani). He was a recognized specialist among pediatric orthopedists of the Soviet Union. He inquired about Ilizarov's method of treating patients with congenital hip dislocations. I will not describe this complex technique in detail, but I will emphasize that G.A. With this pathology, Ilizarov was able to create a new support for the proximal thigh, lengthen the leg so that the patients stopped limping. Abakar Alievich was delighted with this idea and later he himself was the first to successfully use many of the ideas of Gavriil Ilizarov in the country.

Once, when G.A. Ilizarov passed the wire into the proximal thigh, it (the wire) got stuck. Turning to me, he asked: "Magomed, where is our knitting needle?" Without thinking twice, my answer sounded: "Gavriil Abramovich! It seems that she got a little confused along the

way and went to the back of the head of the thigh; to ferry it forward. " Ilizarov did just that. The operation ended successfully. You need to know that no one ever dared to object to him, but then he calmly listened to me and even thanked me after the operation.

Warm memories of Ilizarov from friends. The great Ilizarov also had to overcome enormous obstacles, difficulties, difficulties and even treachery before he received the All-Union and Worldwide vocation. Neurophysiologists believe that "envy is a disease of the brain," and in Christianity, envy is considered "one of the seven deadly sins." Unfortunately, science and medicine are also not free from envy, meanness, lies and even deceit.

Rasul Gamzatovich and Gavriil Abramovich were in great friendship with each other. Rasul Gamzatov's poem dedicated to Gavriil Ilizarov was published in the main newspaper of the Soviet Union, Pravda.

Gavriil Ilizarov, a skilled Luqman,
I will come to Kurgan, but not to visit,
But so that for love that suffered from wounds
You healed the broken bones.
Who gave you good luck talisman,
I only have freedom to guess:
Maybe the mountainous Urals, maybe our Dagestan,
Where you were appointed to heaven from birth?
Forcing any illness to retreat as in battle,
You have earned the right to sorrow,
As to heal a mental dislocation, my friend,
Is harder than a dislocated joint.
Know that God himself would be your student,
If could you, sparing no effort,
The connection of times, Gavriil, could restore,
Like ligaments of human tendons.
And I'll come to Kurgan, no matter if called,
And I'll say: "You will comfort my heart,
A man who with the great power of love
Returnins Hope to People" (1984).

Writer and academician B.Sh. Nuvakhov writes in his book about Ilizarov: "I was friends with this wonderful doctor and scientist. Such personalities are born once a century. I visited him in Kurgan and together with him in many countries of the world and in our native Derbent. Gavriil Ilizarov also visited me with Rasul Gamzatov and his wife Patimat Saidova. Gavriil

Abramovich was a wonderful conversationalist, a man with great dignity and inner freedom. His love for the medical profession was fantastic. " On the same days, the newspaper Moskovskaya Pravda (editor-in-chief MR Poltoranin) published an article by B.Sh. Nuvakhov (he is also a Dagestani) exposing M.V. Volkova.

Director of CITO (Central Institute of Traumatology and Orthopedics named after N.N. Priorov), academician of AMS USSR Volkov expressed to me (a Dagestani) his displeasure with these publications, which became a serious obstacle for me in my scientific and official career. A talented scientist, chief traumatologist-orthopedist of the USSR Ministry of Health M.V. Volkov, unfortunately, then became the main opponent of G.A. Ilizarov, which negatively affected the fate of Mstislav Vasilyevich himself. It's a pity, because together they could raise Soviet traumatology and orthopedics to unprecedented heights on a planetary scale. Here the "friends" of the CITO director also played a fatal role. Better to have one friend with the truth than hundreds of flattery.

At the same time, one cannot fail to note the warm attitude of A.A. Kaplunov to Ilizarov, who dedicated to him the book "Unknown Ilizarov: strokes for a portrait" (Notes of an eyewitness), where A.A. Kaplunov tells about the years of joint work of the author with the famous Russian scientist-innovator surgeon Academician G.A.Ilizarov. It reveals the personality traits of Ilizarov as a person, mentor and leader at the stage of formation of the method of treatment he developed and gaining the first recognition in domestic medical science. A.A. Kaplunov said about Ilizarov: "This is a large personality, a distinctive genius and a great doctor of the twentieth century."

Dmitry Dmitrievich Shostakovich, a great composer and musician, Ilizarov's patient, with the following address characterizes the attitude towards G.A. Ilizarov: "Gavriil Abramovich Ilizarov is dear to me, and I have great respect for his talented employees. Gavriil Abramovich has an amazing gift: to return people to health, efficiency, joy. He doesn't just heal a disease, he heals a person. It would be gratifying if in our country there were more such gifted doctors devoted to medicine and people, as adherents of Ilizarov's teachings. "

I share the delight of Professor L.D. Vorontsov, who argued that "the bone, hitherto considered a little compliant organ, in the hands of craftsmen, when using compression-distraction osteosynthesis, turns almost into clay, some kind of plastic mass that can be easily changed. I am completely delighted with the success achieved by the Ilizarov school! "

G.A. Ilizarov was fanatically in love with his system, worked tirelessly, traveled a lot to many countries of the world with lectures and for demonstration operations. "Genius is the highest ability to concentrate attention on the studied subject," said Ivan Pavlov, Nobel Prize laureate, physiologist.

According to E.I. Ilizarova-Abaeva, "Ilizarov is a reformer who changed the idea of bone surgery in the second half of the XX century." I will quote from the speech of the Honored Scientist of the Russian Federation, Head of the Department of Traumatology, Orthopedics and Disaster Medicine of the Moscow State University of Medicine and Dentistry named after A.I. Evdokimov, Professor Vasily Iosifovich Zorya in Moscow, which took place on November 4, 2017 at the International Conference "TRAUMA-2017": "Gavriil Ilizarov is the apostle of traumatology and orthopedics. There was no such genius, and is not expected in traumatology and orthopedics".

From quotes from Ilizarov himself: "Over the years, I have experienced not only a continuous, but constantly growing interest in my profession, my business. And, of course, the feeling of responsibility for the results of his work, characteristic of a real doctor. Striving to see as many people as possible happy".

Conclusions and suggestions. While the Ilizarov method is clearly a very powerful tool, it is necessary to understand the reasons for its wide range of indications and its current usefulness in the Soviet Union and other Eastern European countries. The financial and technological limitations of the Soviets in providing patients with a sufficient amount of appropriate antibiotics played an important role in the development of the Ilizarov method. The lack of antibiotics, on the one hand, created significant bone and joint diseases for treatment and, on the other hand, limited certain treatment options. The risk of deep infection complicating internal fixation even with closed fractures or clean, elective surgery was and remains high.

There is an acute shortage of goods and services. The Soviets did not have the technology or financial support for prosthetic devices that would make amputation a reasonable alternative for certain muscular skeletal problems. Surgically rescuing a severely deformed limb is cheaper than amputating, even if that means months of hospitalization and rehabilitation thousands of miles from home [14].

The 1970s saw a resurgence in the use of external fixation to treat limb fractures and deformities throughout Europe and the United States. Advances in materials and techniques have reduced soft tissue complications that previously precluded the use of this technique. At the same time in Kurgan, in the then Soviet Union, G.A. Ilizarov developed his own method of distraction osteogenesis. This important achievement contributed to the lengthening of the limbs, the elimination of many complications and a decrease in the volume of surgical intervention. This technique preserves the osteogenic elements in the limb. He perfected a high-frequency, fine-paced distraction rhythm that allowed good bone to regenerate and reduced soft tissue complications such as nerve and vascular damage. This technique produces good quality bone formation, minimizing the incidence of unevenness (requiring further bone grafting) or

premature consolidation of the elongated segment (requiring repeated osteotomy and osteoclase). The lengthening of the limb segment up to 140% is now not only possible, but also commonplace. With his clinical observations and experimental (in KRICETO there is a powerful experimental department with modern equipment) G.A. Ilizarov and his colleagues proved that the healing of fractures when using a compression-distraction system occurs two or even three times faster than when treating fractures using extraal plates and intraosseous pins. Gavriil Ilizarov emphasized that he had developed not only the apparatus, but most importantly, the system of compression-distraction osteosynthesis.

As Ilizarov's methods were mastered in Europe and the United States, advances in materials and biomechanics of external fixators quickly modified the technique. This has expanded the indications for the treatment of congenital and acquired limb malformations. Various external retention configurations modifying the ring retainer to uniplanar and biplanar frames and adding transaxle pins and half pins to wire retention methods are now standard [15].

Complications still interfere with the successful treatment of limb deficiencies. These complications are predictable enough to change the nomenclature in the limb lengthening literature. Only those complications that change the predicted outcome are truly "complications". Future trends towards improving the Ilizarov method will reduce the incidence of complications.

The Ilizarov method is an important addition to the orthopedic surgeon's arsenal of treatment methods. By combining stable external fixation with precise and controlled corticotomy and using a new understanding of the biology of tissue elongation in Western medicine, complex deformities and significant inequality in limb length can be successfully corrected with minimally invasive surgery.

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19. abdulkabirov@yandex.ru 89035773525 June 14, 2021