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GENERAL SURGERY

TEXTBOOK



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LIST OF ACRONYMS

Rh-factor	— Rhesus-factor
BP	— Blood pressure
HLA	— Heart-lung apparatus
ACTH	— Adrenocorticotropic Hormone
DIC	— Disseminated intravascular coagulation
ALV	— Artificial lung ventilation
CT	— Computed Tomography
MPI	— Mannheim peritonitis index
MIC	— Minimum inhibitory concentration
MRI	— Magnetic resonance imaging
NLA	— Neuroleptanalgesia
CBV	— Total blood volume
SBP	— Systolic blood pressure
SIRS	— Systemic inflammatory response syndrome
STH	— Somatotropic hormone
US	— Ultrasound
CVP	— Central venous pressure
CIC	— Circulating immune complexes
HR	— Heart rate
ECG	— Electrocardiogram
EEG	— Electroencephalography

INTRODUCTION

Surgery is a field of medicine that studies diseases and injuries of all areas and organs of the human body, which develops and applies special methods of treatment.

Literally, “surgery” means “working with hands” (from the Greek *cheir* — hand, *ergon* — work), but this concept does not correspond to the place that surgery takes in practical medicine and science. There is no such organ of the human body, which could not be treated with the help of surgical methods. A number of diseases of internal organs, extremities (traumatic injuries, tumours, development diseases and deformities, purulent-inflammatory diseases, etc.) are treated only by surgical methods.

The opinion that surgery aims to remove organs or part of them is true only in cases when it comes to organs that have relatively little importance in the life of the organism (for example, removal of the appendix during its inflammation, it is called appendicitis). However, there are some organs operating which allow restoring functions disturbed by the disease; there are also some organs, the absence or deformation and development diseases of which cause severe physical and moral suffering, especially if it concerns the face, extremities, etc. Correction of certain deficiencies and defects of human organs is the task of reconstructive surgery.

Surgery takes a large place in clinical medicine: about 25% of all pathologies are surgical diseases, which differ in aetiology and pathogenesis. So, there are the following groups of diseases.

1. Inflammatory diseases caused by various microorganisms;
2. Traumatic injuries caused by mechanical, physical, chemical effects on the human body;
3. Vascular diseases: obliterative atherosclerosis, obliterative endarteritis, thrombosis, and embolism;
4. Tumours that represent the atypical proliferation of tissue with a tendency to progressive growth;
5. Parasitic diseases requiring surgical treatment;
6. Development diseases of organs caused by genetic disorders or the harmful influence of external factors on the developing foetus.

The number of areas of medicine where surgical methods of treatment are used is divided into separate sections: traumatology, oncology, ophthalmology, pediatric surgery, obstetrics and gynaecology, neurosurgery, cardiovascular surgery, urology, microsurgery, etc.

According to the age-old tradition, internal diseases remain the priority of physician, but up to a certain stage in the development of the disease.

For example, gastric ulcer, cardiac failures, pneumonia, and other diseases are treated by a physician, but if the ulcer is perforated or there is bleeding, penetration (spreading to other organs), ulcer transformation into cancer, stenosis of the output section of the stomach, an anomaly which sharply disrupts the cardiac function or the complications of pneumonia with abscess of the lung, the patient can be cured only by surgery.

Surgery, as well as therapy, is based on the general fundamentals of medicine: biology, anatomy, physiology, biochemistry, pathological anatomy, pathological physiology, etc. Therefore, the surgeon should be a master of therapeutic methods of examination and treatment of the patient. Only a deep knowledge of internal diseases allows the surgeon to become a truly qualified specialist.

Therapy and surgery are inseparably incorporated. Undoubtedly, both of these fields of medicine are differentiated as separated medical specialities and are the main independent branches of medicine. The continuity of surgery and therapy was noted in ancient times. Thus, in the Hindu writings of Sushruta (6th century BC), it is said that a surgeon who does not know internal diseases is like a bird with one wing.

Knowledge of the basics of surgery is necessary for doctors not only of surgical specialities: every physician should know the clinical manifestations of surgical diseases requiring emergency care (acute inflammatory diseases of the abdominal organs, purulent diseases, internal bleeding, etc.). A physician of every speciality should be able to provide first aid on traumatic injuries, bleeding, accidents, and other emergency states clinical death, perform therapeutic and diagnostic procedures — injections, punctures, catheterisation of hollow organs, blood transfusions, etc.

To assist the injured in emergencies (natural disasters, accidents, catastrophes, military actions), physicians of all specialities are involved, and the lives of many people depend on their skilful actions. A physician of every speciality should be able to provide emergency surgical assistance on acute diseases and injuries — fractures, bleeding, clinical death, etc. All this determines the need to study surgery, in the first place — general surgery.

The course of general surgery includes such topics as aseptics and antiseptics, bleeding, blood transfusion, pain relief, preoperative preparation, and postoperative management of patients, as well as semiotics and prophylaxis of the main surgical diseases, comprising traumatic injuries, inflammatory diseases, tumours, peripheral vascular diseases, development diseases, parasitic surgical diseases.

In the further courses, students study the issues of diagnostics and differential diagnostics of surgical diseases, the technique of surgical interventions, completing the institute study of surgery during the sixth year. Subsequent training includes an internship, clinical internship, and MD.

For successful mastering of surgery, it is necessary to use all the existing forms and methods of teaching the subject: lectures, practical classes, independent work on a book, night shifts in the clinic, work experience at the surgical departments of hospitals and clinics, classes in student scientific societies, meetings of surgical societies.

Chapter 1

HISTORY OF THE SURGERY. ORGANISATION OF SURGICAL CARE

There are moments when it is useful to turn over a few forgotten pages of the medical history, and perhaps not so much forgotten, as for many unknowns to cover and understand the present.

I.I. Burdenko

The Surgery began to develop much earlier than other medical areas, namely, practically almost in the early days of humankind. The constant companions of man were hunting, wars, and he was forced to learn how to stop bleeding, remove arrows from the body, etc. But although surgery has undergone such a long path, it was shaped as science only in the XIX century.

1.1. DEVELOPMENT OF THE SURGERY BEFORE XIX CENTURY

People in antiquity made attempts to stop bleeding by a wound compression, raising an extremity upwards, dusting the wound with ashes and applying a bandage helping themselves and each other. Dry moss, leaves, etc., were used as a surgical dressing. Skeletons with trephine openings in the skull and amputated extremities were found during excavations of ancient human sites. The study of bones shows that people lived with these defects for a long time, i.e., primitive surgical care was sometimes effective in ancient times.

The study of mummies, drawings, hieroglyphics found during excavations in Egypt, India, Greece, China, allows getting an idea of the surgical care level at various stages of human history.

The level of medicine development, including surgery, was quite high in Ancient Egypt. Thus, about 6,000 years BC there were successfully performed such surgeries as extremities amputation, castration, removal of concrements from the bladder, craniotomy. Cast paddings were used for fractures, various natural products such as honey, oil, wine, etc., were used for wounds treatment.

Surgical instruments such as lancets, tweezers, mirrors, syringes, etc., were widely used in ancient India 1,500 years BC (known are 120 names of such instruments). Indians performed various surgeries, including caesarean section, and the principles of nose surgery with an advanced flap (a method known in surgery as “Indian”) have not lost their significance in current time. Sushruta’s writing says: “surgery is the first and best of all medical sciences, a highly valued work of Tiba and a true source of fame”.

Surgeons are known to perform very complex surgery in Babylonia and punishment for a badly performed surgery was determined by the code of King Hammurabi, written in the XVIII century BC: “If a physician performs a serious surgery with someone using a bronze knife and causes the patient to die or if he treats a cataract from someone’s eye and destroys the eye, he will be punished by mutilation”. A special social category of surgeons existed in Babylonia and Assyria. Only surgeons were considered physicians in Babylonia.

Information about the surgeries indicates a high level of surgery in ancient Greece: stopping bleeding, treating wounds, amputations, medical care providing at war. The famous Homer’s aphorism says: “One skilled healer is worth many warriors”. The physician of ancient Greece, Hippocrates (c. 460–370 BC), who is rightly considered the father of scientific medicine and surgery, is widely known. The basic principles of wounds treatment, taking into account purulent complications, are shown in his works. His principal *Ubi pus ibi evacua* (where [there is] pus, there evacuate [it]) is fundamental in the treatment of purulent-inflammatory diseases in current time. The use of hypertonic solution (seawater), metal drainage for the purulent wounds treatment predetermined the development of antiseptics. Hippocrates recommended preparing the surgical area, keeping clean during surgery, using boiled rainwater, using extremities immobilisation with frames for fractures, using stretching for matching fragments. They offered several other techniques and surgeries. However, the Hippocrates contribution to medicine is most valuable since he developed the foundations of scientific medicine and surgery. Celsius and Galen were Hippocratic followers in ancient Rome. The medical and surgical practice was based on the Hippocrates’ works for the next ten centuries, up to VIII century AD.

Surgery was further developed in Ancient Rome. The investigation of Celsius and Galen were of great importance. Celsius lived in the I century AD and considered himself a Hippocrates apprentice. He described such surgeries as extremities amputation, cataract extraction, the arrest of bleeding by vasoligation in the surgery sections in his encyclopedic writing “Art” (“Artes”).

He was the first in Europe who describes local signs of inflammation (swelling, erythema, fever, pain).

Galen made a huge contribution to surgery and medicine (c. 130–200 AD). The principles laid down by him dominated in the science for the next few centuries. His colossal merit as a scientist consists primarily in introducing the experimental method of research into medicine. His systematic anatomy and physiology data became the starting point for scientific studies in medicine and surgery. Galen described the technique of various operations (methods of hemostasia, plastic surgery on a cleft lip, etc.), suggested new suture materials — silk, string threads.

The significance of the scientific contribution of Hippocrates, Celsus, Galen was so important for medicine that their teaching was the basis for medical practice for several centuries, up to the VIII century. Byzantine Paul of Aegina (VII century) performed the most complicated operations using vessel ligation (amputation, tumour removal, and aneurysms removal) based on this teaching.

Abū Alī al-usayn ibn Abd Allāh ibn Sīnā, known as Avicenna (980–1037), made a great contribution to the development of surgery. He proposed using wine for wounds disinfection, first applied nerve suture, used elongation with fractures, plaster cast, described operations such as tracheotomy, removing kidney calculi, etc. His famous work, “The Canon of Iatric Science”, was translated into European languages and remained a handbook for doctors until the XVII century. Avicenna stands near Hippocrates and Galen for the contribution to medicine.

The dominant influence of the church suspended the development of science, including surgery in the Middle Ages. The prohibition of autopsy affected the development of anatomy, and it was forbidden to engage in surgery on the grounds in 1215 that the Christian church was “disgusted with the shedding of blood”. Thus, surgery was excommunicated from medicine and likened to barbers. A barber (hairdresser) cut hair, shaved and treated with Letting of Blood. Even 300 years later, Thomas Vicker, the archiater, author of the first textbook “The Anatomy of the Human Body” was only a member of the barbers’ guild rather than the Royal Medical College.

The universities with departments for physicians appeared in Italy (Padova, Bologna), France (Paris) in the late Middle Ages. The basis of training was internal diseases. Surgery was excluded from teaching because it did not correspond to the religious beliefs of that time. However, the prohibition of surgery could not stop its existence, because patients needed help from physicians who could treat wounds, fractures, dislocations, arrest

bleeding, etc. Such people, who did not study at the university, learned from each other, handed over surgical skills from generation to generation, united into a special guild. Surgery continued to develop even in that difficult time for science. The basis of surgery were the works of Hippocrates, Celsius, Galen.

Italian and French surgeons made a great contribution to the development of surgery. The Italian surgeon Lucca (1200) developed a wounds treatment method using alcohol and used sponges with evaporative substances for pain relief; inhalation of which led to the loss of consciousness and sensitivity. Those studies laid the fundamentals of general anaesthesia, which is undeservedly forgotten in current time, and priority is attributed to other scientists. Bruno da Langoburgo (1250) identified two types of wound healing based on long-term observations — by primary and secondary intention (*prima, secunda intentie*), which has been of crucial significance for the wound process theory up to the present day. Italian surgeons Rogerius and Rolando developed the intestinal suture technique. The rhinoplasty technique currently used and known as Italian was developed in Italy in the XIV century by the Branco family.

Famous surgeons of the XVI century were Swiss surgeon T. Paracelsus (1493–1541) and the French surgeon A. Pare (c. 1509 or 1510–1590). T. Paracelsus is known not only as a sophisticated military surgeon but also as a chemist. He made a significant contribution to the wounds treatment using astringent remedies and chemicals. Paracelsus played a huge role in natural processes in the treatment, considering that “nature itself heals wounds,” and the purpose of the doctor is to help nature.

Ambroise Paré is a well-known military surgeon who successfully treated wounds. He gave up on the idea of gunshot wounds existing at that time as poisoned and healing wounds using boiling oil, considering this method harmful and not always effective. He used to arrest the bleeding by vessel ligation in the wound (the method proposed in the I century by Celsius and forgotten by the time). Paré proposed an internal podalic version in case of pathological labour, being an obstetrician. This method is currently used in the obstetrics.

Paré’s work played a large role in the development of surgery as a science and the transformation of the artisan-surgeon into a competent physician.

Andreas Vesalius (1514–1564), the founder of modern anatomy, played a great role in surgery development. This distinguished anatomist and surgeon considered the knowledge of anatomy as the basis of surgery, and his book “*De corporis humani fabrica*”, based on factual material obtained during the autopsy, played a large role in the subsequent following surgery development.

A breakthrough discovery by Harvey (1578–1657) of the circulatory system, based on his own and previous heart and vessels anatomy studies (including Vesalius), was significant in the development of medicine and surgery. Harvey believed that the heart, arteries and veins are a single system in which the heart plays the role of a pump. He discovered two circulations and proved that it is not air that circulates in the vessels of the lungs, as it was then considered to be, but blood. Vesalius and Harvey were severely subjected to persecution by the church and scientists for their studies, disaccorded with the church dogmas. Vesalius was forced to leave Italy and became court physician of the French king Charles V.

Surgery was officially recognised as a science in 1719 when the Italian surgeon Lafranche was invited to the Sorbonne medical faculty to give surgical lectures. Training of certified surgeons begins from this period. The acknowledgement of surgery was not accidental, because numerous wars played the main role in Europe, and the treatment of gunshot wounds, severe complications called for in-depth training of physicians, revision of medical education and the surgeons. The first special educational institution for the surgeons — the French Academy of Surgery — was founded in Paris in 1731. The merit of its establishment belongs to the surgeons Peytroni and Marechal, and its first head was the famous surgeon J. Pyaty. The Academy was not only educational but also a scientific institution that united French surgeons: scientific studies were carried out at the academy, scientific works were published, which contributed to the development of surgical science.

At the same time, special medical schools for surgeons, surgical hospitals are being opened in England.

The training of surgeons was organised in Russia earlier than in other countries, and surgeons were officially recognised as specialists. The bone-treatment schools were founded in 1654 as directed by Tsar Alexey Mikhailovich. Pharmaceutical order was established for guidelines of the doctors teaching and the medical organisation. The world's first factory of surgical instruments was founded in 1704 in St. Petersburg, now known as the Krasnogvardeets factory. The first hospital in Russia was established by a decree of Peter I in 1706 in Moscow across the Yauza River, and a medical school was founded at the hospital in 1707 (this hospital is now the Main Hospital of the Russian Army named after N.N. Burdenko). Military and Admiralty hospitals with surgery schools were founded in St. Petersburg in 1716 and 1719 by a decree of Peter I. Education required a change in the structure of institutions, and the medical schools were reorganised into medical-surgical schools in 1733. Medical-Surgical Academy in Moscow and St. Petersburg were founded in 1798.

The foundation of a university in Moscow in 1755, where the medical faculty was opened in 1758 had special significance in the development of science in Russia. Foreign professors taught surgery at the medical-surgical schools, academies, and university. K.I. Shchepin (1728–1770) was the first Russian professor of surgery. Great importance was assigned to the study of anatomy and practical training, the technique of operations on corpses from the beginning of surgical teaching at Russian educational institutions. It was prescribed in the instructions of the XVIII century for professors of surgical sciences: “...The operator must order that during the operation, all the tool should be at their place and in such a state as if the operation was performed on a living person”. Department of Surgery (now — Department of General Surgery of MMA named after I.M. Sechenov) was founded in 1804.

In 1844, the Medical Faculty of Moscow University and the Moscow Medical-Surgical Academy were united, which allowed focusing on the teaching of medical disciplines, training of doctors, scientific studies and clinical work. Thus, it was supposed to increase the efficiency of university studies. The Medical Faculty of Moscow University in 1930 was reorganised into the 1st Moscow Medical Institute named after I.M. Sechenov (since 1990 — Moscow Medical Academy named after I.M. Sechenov).

1.2. DEVELOPMENT OF SURGERY IN XIX–XX CENTURY

A rapid jump occurred in one century, beginning in the middle of the XIX century, in the development of surgery, and the level achieved many times surpassed all progress over the preceding millenniums. This was promoted by the discoveries of the XIX and early XX centuries, which were the basis of the subsequent development of surgery: the discovery of anaesthesia, introduction of anaesthesia and local anaesthesia into surgery, the development and introduction of aseptics into surgical practice, methods for arresting bleeding and blood loss, development of the modern anatomy, development of the topographic anatomy and improving surgical techniques.

In 1846, a revolution in the surgery area was made by U.T. Morton, an American dentist who performed painless oncotomy and in the subclavian region, using inhalation of diethyl ether vapours, which allowed him to turn off the patient’s consciousness and get a complete loss of pain sensitivity. Obstetrician J. Simpson introduced chloroform anaesthesia into clinical practice a year later.

The prevention of purulent postoperative complications, which led to the death of most patients, was made possible by J. Lister, who developed

an antiseptic method for wounds treating and preventing purulent complications. Use of phenol (carbolic acid) for soaking bandages, hand-washing, and air sterilisation in the surgery room by air-spraying has become widespread.

Further development of the antiseptic method led to the emergence of aseptics, which is a method of preventing wound suppuration, based on the principle of the microbes elimination at all objects in contact with a wound, using high temperature. In 1885, M.S. Subbotin founded a special operating room in which he used a pre-sterilised dressing material, and then a student of N.I. Pirogov E. Bergman developed a method for dressing material and surgical instruments sterilisation with steam or boiling water.

N.I. Pirogov's vessels topographic anatomy works and the suggestion of F. Esmarch (1873) on use of a bleeding tourniquet, were significant for bleeding arrest during surgery. The special occlusion clamps (T. Kocher, I. von Mikulich-Radetzky, J. Pean), which are currently used, were developed and realised in the 80s of the XIX century.

The discovery of blood groups had great significance for the replacement of blood loss by L. Landsteiner (1901) and Y. Yansky (1907), which allowed to transfuse blood to patients and perform massive operations with the internal organs.

The development of applied topographic anatomy is associated with N.I. Pirogov. Perfect knowledge of anatomy, topographic arrangements between organs contributed to the improvement of surgical technology, which reached the highest level. This was determined by the need to quickly perform the surgery since the methods of anaesthesia were imperfect, and the operations were performed almost without anaesthesia. N.I. Pirogov showed types of surgical techniques. He performed high bladder cross-section and removing calculus within 2 minutes, and osteoplastic amputation of the foot according to the method he developed — within 8 minutes. The surgeon of the Napoleonic army D. Larre performed 200 extremities amputations in one day during the Borodino battle.

“Whoever diagnoses well, he treats well” — this Latin aphorism is directly associated with surgery. Only an accurate diagnosis allows for choosing the right treatment. The discovery of rays by the physicist V.K. Rontgene, later named after him (1895), had great significance for the development and improvement of surgical science, as well as medicine in general. The diagnostic methods developed on this basis have great importance in current time.

The XX century in surgery was marked by the development of cardiac, reconstructive surgery, transplantology. The basis of modern cardiac surgery

was laid down by Russian surgeons S.S. Bryukhonenko and S.I. Chechulin. In 1924, they developed an artificial blood-circulation apparatus (AIC) that allows performing open-heart surgery operations.

After improvement, the device was used in clinical practice by the American surgeon D.N. Gibbon in 1953. The year 1914 surgery should be considered the beginning of cardiac surgery when the French surgeon M. Tufier was the first to expand the arterial valve with its narrowing. In 1938, R. Gross (USA) bandaged the arterial (Botallo's) duct.

In 1944, the Swedish surgeon K. Crafford resected the aorta with its coarctation. Cardiac transplantation was developed in detail and successfully performed under experimental conditions by Z.P. Demikhov, who mastered the transplant method of K. Bernard, who for the first time successfully transplanted the heart in 1967 in Cape Town (South Africa). In Russia, human heart transplantation was performed in 1968 by A.A. Vishnevsky. However, due to the absence of a corresponding law on the donor's heart, operations were suspended and resumed only in 1987, when V.I. Shumakov performed successful heart transplantation.

1.3. DEVELOPMENT OF SURGERY IN RUSSIA

Official references to medicine in ancient sources in Russia are found only in Kyivan Rus', where qualified physicians worked. But this does not mean that the treatment in Russia was not provided in more ancient times, and surgical methods were not used.

Wounds and fractures were treated, foreign bodies (arrows, stones) were removed, bleeding was stopped. Medical care in ancient Russia was provided at monasteries, where there were hospitals, where patients received care and found shelter. The surgical care was insignificant and comprised cauterisation of wounds, ulcers, letting of blood, forcible reduction of deformities, lancing of abscesses, etc. That was performed by healers, barbers. Official surgical education at that time, as in all countries of the world, was not performed. However, in Russia, special education of surgical care began to receive attention earlier than in Europe, and the first traumatological schools were established by a decree of the Tsar Alexey Mikhailovich in 1654. A lot was done to organise the treatment of surgical patients by Peter I, including the opening of hospitals, medical schools, the first factory of medical instruments.

The establishment of medical-surgical academies in St. Petersburg and Moscow (1798), universities and medical faculties contributed to the

development of surgical science: in Moscow — in 1758, in Kazan — in 1804, in Kharkiv — in 1805, in Kyiv — in 1834.

Difficulties and complications in learning were due to the lack of textbooks in Russian. The first such textbooks were written by P.A. Zagorsky (1764–1846) — on anatomy, and by I.F. Bush (1771–1843) — on surgery. Professor I.F. Bush did a lot for teaching surgery at the St. Petersburg Medical and Surgical Academy, and his textbook “Guide to the surgery teaching” (1807) was a handbook for students and surgeons for many years. He also established a large surgical school, the most important representative of which is I.V. Buyalsky (1789–1866). He was a talented anatomist, surgeon, artist, manager. The outstanding surgeon I.V. Buyalsky performed the most complicated operations at that time: resection of the upper jaw, removal of aneurysms. The original “Anatomical-surgical tables” created by him played an important role in the study of surgeries. It was translated into European languages and used for training surgeons in Europe and America. The Medical Instruments factory directed by I.V. Buyalsky regulated the production of many original instruments, which (for example, the Buyalsky Wound Scoop) are used now, more than 150 years later. Buyalsky was highly appreciated at the Art Petersburg Academy, of which he was a consultant for a long time. The all-around talent and authority of I.V. Buyalsky contributed to the establishment and recognition of the Russian surgery and determined the further direction of its development in Russia.

The founder of the surgical school was I.F. Bush in St. Petersburg. His students worked at the universities of Vilnius, Moscow, St. Petersburg. Simultaneously with I.F. Bush, surgeon E.O. Mukhin (1766–1850) worked in Moscow as an anatomist. Professor of Moscow University E.O. Mukhin founded a school of Russian physicians and anatomists. We owe him the discovery of N.I. Pirogov, an ingenious scientist and surgeon.

N.I. Pirogov (1810–1881) was a genius of Russian science. He was the best student of E.O. Mukhin. He graduated from the Medical Faculty of Moscow University at the age of 18 and was sent to continue his education, first to a professorial institute in Dorpat, then to Germany by a recommendation of his teacher. The most prominent surgical school was considered the German school in the XIX century. With the beginning of professorship at the University of Dorpat, where N.I. Pirogov worked for six years. He attended to anatomy, created applied (topographic) anatomy having started work at the University of Dorpat. He studied the locations of the organs in three dimensions on sections using the method of freezing and corpses cutting. During those years, he wrote the classical work “Surgical anatomy of arterial trunks and fascias”.

N.I. Pirogov said that the surgeon must deal with anatomy since, without knowledge of anatomy, surgery cannot develop, but knowledge of anatomy must be combined with the surgical technique. N.I. Pirogov was a virtuoso of surgical techniques, as he said, thanks to the knowledge of anatomy and surgery. Knowledge of the clinical manifestations of the disease is equally important for the surgeon. In his work "About the difficulties of surgical diagnosis and the surgeon's happiness" N.I. Pirogov said: "The case is still waiting for us, there are still enough errors in the diagnosis, depending on the imperfection of knowledge or on a casual reason that has relaxed attention, and the fatal outcome is obvious". N.I. Pirogov was not only a virtuoso surgeon but also an excellent diagnostician. Such historical fact is known. Famous English, French, Italian and German surgeons (including Billroth) could not diagnose wounded Garibaldi, but N.I. Pirogov diagnosed the bullet in the heel bone. Of course, it would not have been difficult to determine using X-ray in current time; however, Pirogov made an accurate diagnosis based on the clinical manifestations of the disease. In 1841, the 31-year-old a world-famous surgeon, N.I. Pirogov was invited to the St. Petersburg Medical-Surgical Academy, where his many-sided talent came into full play.

The contribution of N.I. Pirogov into surgery is great. As it is known, the basis for determining the surgery development is the applied anatomy, the anaesthesia introduction, aseptics and antiseptics, methods of the bleeding arrest. N.I. Pirogov contributed to all these sections. He developed a modern applied (topographic) anatomy widely introduced ether anaesthesia (he first used anaesthesia in the military, using it to perform 10000 operations), developed new methods of anaesthesia, which are rectal and endotracheal. He studied the anatomical background of bleeding arrest (vascular topography), developed methods of ligation of the aorta, lingual artery, and surgical extraperitoneal approach to the iliac vessels. N.I. Pirogov antedated the Lister and Semmelweis studies, believing that the cause of purulent postoperative complications is the infectious origin ("miasma"), which is transmitted from one patient to another, and the carrier may be medical staff. He used antiseptics to eliminate the miasm, tincture of iodine, alcohol, argentic nitrate solution, etc.

A special place is occupied by the work of N.I. Pirogov on military field surgery, his classic work "The Fundamentals of General Military Field Surgery" has not lost its value to this day. His classic work "The Fundamentals of General Military Surgery" is relevant up to these days. He developed the basic principles of military surgery: the drawing of medical aid closer to the battleground, the triaging, the continuation of assistance at the evacuation

phases, and setting up mobile hospitals. These principles of organising care for the wounded became the foundation of the doctrine of military surgery, and they were used to provide medical aid during the Great Patriotic War of 1941–1945.

N.I. Pirogov used a plaster cast in the treatment of fractures, developed the basic guidelines of antiseptics during the war. He described the traumatic shock.

At the age of 45, N.I. Pirogov left the Medical-Surgical Academy and devoted his whole life to literary and social activities, making a great contribution to the organisation of education as an inspector of public education in Odessa and Kyiv provinces. The monument to the sacrificial doctor, patriot and scientist were erected in front of the building of the faculty of the surgical hospital of Moscow University in Bolshaya Pirogovskaya Street after the death of N.I. Pirogov in 1881. N.V. Sklifosovsky said at the opening of the monument: "...The people who had their Pirogov shall have the right to be proud..."

N.I. Pirogov's contemporary was F.I. Inozemtsev (1802–1869). Together they studied surgery in Germany. F.I. Inozemtsev headed the department of surgery at the Moscow University. The merit of F.I. Inozemtsev in surgery is that he indicates the role of the sympathetic nervous system in the development of diseases, widely used instrumental methods for the diagnosis. He made a great contribution to the spread of ether and chloroform anaesthesia in Russia.

K.K. Rayer (1846–1890) was the main propagandist of antiseptics in Russia. He studied antiseptics at the Joseph Lister's clinic and successfully mastered his methods. Together with N.A. Velyaminov, he used an antiseptic method for the treatment of wounds during the Russian-Turkish war (1877–1878). Based on the experience of military surgery, K.K. Reier proposed and widely used primary surgical wounds treatment. His great experience was summarised and reported to the World Surgeons Congress in 1881. Surgeons praised his method with the recommendation of widespread use in wound treatment.

Improvement of the Lister antiseptics method led to the rejection of the phenol use (carbolic acid) as an antiseptic, The student of N.I. Pirogov, S.P. Kolomnin (1842–1886) used salicylic acid replacing a simple dressing with a multi-layer occlusive dressing. S.P. Kolomnin is also known by his works for blood transfusion. He had the greatest experience in this field in Russia.

The development and introduction of the physical antiseptics into practice are associated with the name of M.Y. Preobrazhensky (born in 1861, the year of death is unknown). The aseptic method in the clinical practice used

by M.S. Subbotin (1848–1913) and the military doctor L.L. Heydenreich (1846–1920) together with K. Weigert, modified the autoclave for sterilisation of dressing material, surgical clothes and instruments, which made it possible to introduce an aseptic method in surgery in 1884.

After N.I. Pirogov, the development of Russian surgery is largely associated with Sklifosovsky (1836–1904). He worked in Kyiv, St. Petersburg, Moscow; at the Moscow University, headed the department of faculty surgery. N.V. Sklifosovsky was one of the first in Russia to develop the antiseptic method, modified the Lister method, using mercury dichloride and iodoform as the antiseptic agents. He was a versatile surgeon, operated on the stomach, bones, and brain. He developed the bone operation known as the “Russian castle” due to the comparison and fixation types of bones. N.V. Sklifosovsky paid great attention to the training of surgeons, and he organised the Institute for the Improvement Training of Doctors in St. Petersburg.

A.A. Bobrov (1850–1904) is the author of surgeries for cerebral hernia, a Russian surgeon of the second half of the XIX century. His works of bone tuberculosis played a large role in a differentiated approach to the treatment and surgical tactics. He developed infusion therapy for the treatment of surgical patients, created a special apparatus currently used (the Bobrov apparatus). He is the founder of a large school of surgeons, including such great physicians as P.I. Diakonov and S.P. Fedorov.

P.I. Dyakonov (1855–1908) went from a doctor of the county hospital to the head of a surgical hospital of Moscow University. He is one of the founders of pulmonary surgery. He was one of the first to perform lung surgery, the oesophagus resection. Paying much attention to the surgeons' education in Russia, P.I. Dyakonov considered it is necessary to create a printed organ for surgeons. Thus, the magazine «Surgery» appeared, and he was the first editor of this publication.

The first half of the XX century is no less significant for surgeons than the second half of the XIX century when there was a rapid jump in its development. Russian surgery developed along with world science. The development of cardiovascular surgery is typical for this period: introduction of artificial circulation; appearance of reconstructive surgery of the heart and blood vessels, surgery of congenital and acquired cardiac defects and coronary heart disease, surgery of the lungs, trachea and bronchi, oesophagus, liver and biliary tract, pancreas, organ transplantation (kidney, heart, liver); microsurgery, endovascular surgery, etc.

Russian science has been enriched with a brilliant cast of outstanding surgeons whose names have entered the history of medicine forever.