At the Beginning of Vacuum Therapy: from the Blood-Sucking Cups to the Bier-Klapp Method

Andrey Larichev, MD*

Abstract - A brief digression to the history of development of a method of vacuum therapy includes documentary recorded sequence of use of the low-dosed negative pressure in medical practice, including in treatment of wounds and a wound infection from the most ancient times to an era of origin of antibiotics. Evolution of technical solutions and the relation to a method which had the success and oblivion periods is presented. Expansion of area of its application was always accompanied by positive effect and every time gave to hope for the solution of many problems to surgeries. In this regard exclusive value gets that fact that at all options of practical realization of a method from dry banks, Junod and Klapp's devices to a Bier's stagnant hyperemia is found the same pathophysiological mechanism connected with change of blood circulation in a zone of influence by vacuum. This circumstance provides medical efficiency of a method which in all cases it would be fair to call vacuum therapy.

Keywords — August Bier, hyperemia, vacuum therapy, history.

I. INTRODUCTION

In medical science and practice, there are many problems that had for many years awaited decisions receive periodic pulse optimistic future and a number of objective circumstances again become status quo. In this regard, special attention to the questions of treatment of wounds and wound infection. Since then, as man appeared, he was troubled by various wounds that had been the object of attention of traditional healers and medical professionals. Currently, the surgeon's arsenal contains a huge variety of methods to treat the wound, but not all of them are widely used in practice.

The vacuum therapy takes special place amongst the various methods of wound treatment. It is worthy of respect and admiration for all that its associated with it in the past, present and future. Experience of vacuum therapy used in medicine has a long history, which has undergone various periods of development from its climax to its relative neglect. August Bier said:

"Happy thought of using a dry jar to suck the pus was performed in ancient times and always was applied in practice, but haven't found general acceptance. The use of this venerable instrument was spread among all nationalities of the world in all historical times" [1].

II. THE ANNALS OF HISTORY

The origins – in traditional medicine

Being a powerful healing factor, this physical facility has origins in the old past of traditional medicine. In the treatment of wounds after bites of rabid dogs and venomous animals primitive and ancient civilized peoples used various tools – animal horns, hollowed gourds, bamboo canes and other items. In process of technical progress instead of the called primitive devices they began to make devices of glass and metal in the form of a bell or a pear.

For vacuum creation by a mouth they deleted air from capacity through a special hole. Upon termination of aspiration by means of language this hole was closed by wax or other substance which was in a mouth of the healer. Depression in the device provided also by burning of combustible substance in its cavity or due to short-time deduction of the device over a flame.

Close connection of a method with traditional medicine is brightly presented in the novel of the well-known Russian writer M.A. Sholokhov "Virgin soil upturned" in which Mamychikh's local grandma-healer relieved of suffering of one of heroes – the grandfather Shchukar, by means of a clay pot, establishing it upside down on a stomach [2]. Credibility of a plot doesn't raise doubts. The evidence is that these way women resorted to mastitis treatment in country families [1].

In Russia there are popular banks which are used in cold treatment. Thinking of the mechanism of positive influence of this means, the academician I.P. Pavlov spoke about its reflex nature. Later on the basis of a pilot study A.K. Kolomiytsev (1960) came to a conclusion that the positive effect of this revulsive is connected with emergence of the general and local neurotropic effects in the conditions of the low-dosed vacuum [3].

Medical vacuum influence was used not only by folk healers. The images which have remained so far testify to it on obelisks and temples of Ancient Egypt which document and visually represent this method in operation [4]. It is for certain known that, being engaged in treatment of wounds, the surgeon of
school of gladiators and court the doctor of the Roman emperor Claudius Galen (Galenus) used the adaptations similar in a form to medical banks. The classic to the antique medicine believed that thus from tissues the toxic agents getting through a wound and defiant various diseases are removed.

The great scientist and the thinker of the East Abu Ali ibn Sina known in Europe as Avicenna had huge practice of the court doctor. In the encyclopedia of theoretical and clinical medicine – "Canons of medical science" ("Kanusfi’I Nibb"), he mentions an original way of clarification of an organism by means of cans. Their usefulness was equated to a blood evacuation by bloodsuckers and by analogy to them efficiency of vacuum influence spoke.

Avicenna’s canonized treatises had extreme popularity in Asia and Western Europe. Up to the Middle Ages they were the obligatory management for physicians. In China sore joints, various gripes and even pneumonia was object of magic action of cans. Doctors of Mongolia, Korea and Japan saw advantage of this method of treatment and improved itself to the can, making it in glass or ceramics [2]. It is possible therefore the history kept in an irrevocable look to bank as medical means which the French philosopher and the humanist Michel de Montaigne mentions. Telling in the essay "Experiences" (1580-1588) about life and customs of contemporaries, he created a realistic portrait of medieval European society and testified that in those days as a way of clarification of an organism "poor blood" suction by means of medical banks was used [5].

In the Middle Ages the application of "the blood-sucking cans" was one of the main ways of healing which were practiced by representatives of various medical estates. Along with barbers and surgeons with special success bathhouse attendants (balneatores) used them. By the way, this procedure played a fatal role in destiny of public baths and those who had there quite lawful medical practice. It was suggested that in these institutions statement of cans promotes syphilis distribution. The version was so convincing that functioning of baths as "medical institutions" stopped, and together with them the special shop of physicians – bathhouse attendants disappeared [4].

**Technical modifications and "hämospasie"**

Not dying away interest to a physical factor to vacuum promoted technical improvement of devices. In 1798 the English doctor Smith created the tight camera by means of which he treated inflammatory diseases on extremities. Depression in the camera was supported by about 20 minutes. That time people already believed that the medical effect is reached due to formation of the stagnant hyperemia which is a source of additional blood supply of suffering tissues. At the end of the XVIII century for creation of vacuum people began to use the pump – "a sucking syringe". Blatin has put into practice the rubber cylinder providing reliable isolation of the system's internal environment and kept the necessary extent of depression in capacity due to elasticity of rubber [6].

Incredible furor in medical society was made by the device which was developed by the French doctor of Victor Theodor Junod. Results of clinical approbation of the device were presented at meeting of the French Academy of Sciences [7]. The device had some modifications, and during some years changes were made to its design. The greatest popularity was received by cylindrical capacity for a hand and so-called "Junod's boot". In 1838 the similar device was described by Erpenbeck [8].

Among those who was the pioneer of scientific approach to an explanation of efficiency of negative pressure in medicine, people fairly call James Murray. One of his first works was published in 1834 in the «The Lancet» magazine. Influencing vacuum soft tissues of a healthy working mammary gland, Y. Murray observed local vascular reaction in the form of expansion of arteries which, in his opinion, was at the heart of strengthening of milk production. In practice he used the special adaptation for removal of pus from an abscess cavity, including from deeply located abscesses through the formed long fistula. Creating various options of devices, J. Murray expanded scope of negative pressure, treated various sharp and chronic inflammatory diseases and even cholera. We will notice that his ideas are cornerstone of development of such method of treatment, as hyperbaric oxygenation [9, 10].

Many people believed that the basic principle of operation of applied devices consisted in creation of a hyperemia which along with revulsive (distracting) medical influence caused the effect, being called "hämospasie" (on Bonnard: αἷμα – blood, πάυει – suck). It’s using they considered as necessary at the most various pathology, from inflammatory diseases to rheumatism and tuberculosis. The most solid analysis of achievements on this matter was presented by Robert Ficinus in the book "Die Hämospasie" (1848) [8].

**Blood-sucking cup and suction drainage**

In spite of the wide range of indications for using vacuum, for years this physical factor has been most widely applied for aspiration of wound discharge. Thus, in 1849 N.I. Pirogov, the patriarch of the Russian medicine, presented his extensive notes "The Report on Travel in the Caucasus" where he presented in great detail his findings on external injuries. Displaying the knowledge of a professional and the inquisitiveness of an explorer, he analyzed various clinical observations, including his experience in treatment of gunshot wounds. He wrote: "In many cases, I successfully replaced incisions with applying blood-sucking cupping glasses to the entry and exit openings, drawing the excreted blood out of these openings with a small pump. Sometimes I even managed to draw small foreign bodies out of the bullet canal". The well-known surgeon used "blood-sucking cupping glasses" (cucurbitae cruentae) of different shape, which were equipped with a piston pump for creating air rarefaction and drawing in the soft tissues for enhancing the blood influx. As a matter of fact, Pirogov regarded such wound therapy as antiseptic measure, though the term had not yet existed. In all fairness, we should admit that his experience also led him to a different idea: "I cannot overestimate..."
this method in treatment of gunshot wounds, penetrating into muscles and loose tissue, if opening it wide with the knife would be inappropriate for some reason." In other words, he warned his followers that they could not hope for the success of the "bloodsucking cupping glass" treatment and replace surgical treatment of wound with this method [11].

At the same time, the first report on the closed method of treating infectious and inflammatory diseases using active aspiration of exudate from abscess cavity appeared. In his monograph "Traite pratique de la suppuration et du drainage chirurgical," published in Paris in 1859, Edward Shassainac described the drainage system he used, paying special attention to the ability of vacuum to remove the contents from the abscess cavity [12]. Later, the method became common surgical practice.

Further elaborating on the idea of closed treatment of abscesses of various localizations, M.S. Subbotin (1894) recommended using the "drainage pump" he developed, comprising a tube and a rubber spray pump. Among various options of application of vacuum in surgical practice great value allocated for a technique of removal of inflammatory liquid by its aspiration in "an air stream". This principle was offered still by O. Heaton in 1898 [13]. R.C. Chaffin (1934) reanimated this idea by his works. He modified necessary devices and in 1942 took out the patent for a surgical aspiration drainage and irrigational tube. A knowing the effectiveness of the aspiration method, Yates stated with satisfaction back in 1905 that there were few things in medicine that solved as many problems as the active drainage did, although it did have certain disadvantages [15].

An important milestone in the development of thoracic surgery was Bulau's proposal (1891) to use suction drainage, which still remains one of the efficient and frequently used methods, in pleural empyema. The appreciation for this method is expressed in the authoritative opinion of V.F. Voino-Yasenetsky (1956): "Bulau's permanent syphonage is an excellent idea and it can be an indispensable treatment method in many cases" [16].

**Bier's Hyperemic Treatment**

The brightest trace on vacuum application in surgery was left by the German surgeon August Bier. The first works of the scientist-tester devoted to vacuum therapy fall on the end of the XX century. His book "Hyperämie als Heilmittel" (1903) has become top – an "Everest" of scientific researches of that time [17]. Least, several editions in English and German languages and had extraordinary popularity [18-22]. The real interest to this work was the cause for its publication in Russia practically at the same time in two independent translations: members of the Yaroslavl society of doctors under G.G. Falk's edition and the doctor of medicine A. A. Ivanov with additions of the author for the Russian edition [1, 6]. In it ways of receiving the necessary effect of a stagnant hyperemia – heat in the form of compresses from gruels, dirt, peat, thermofer, beam warmth and hot air, and also "stagnant bandage" and "distracting" means (mustard plasters, iodide tincture, nitrate silver) are in detail shined. A. Bier gave special attention so-called to "exhausting devices" and "dry banks" by means of which they created a hyperemia due to impact on tissues by vacuum.

Being engaged in technical modernization of devices, he altered the Yunod's device, making it with transparent glass which allowed controlling a condition of a zone of influence visually. It was cheap in production, it could be processed easily. Reliability of sealing was provided by means of a special closing device. Many ideas of the German scientist were received a successful embodiment in practice thanks to cooperation with the technician C. Eschbaum [1, 6].

Concerning possible area of use of the artificial hyperemia created by "exhausting" devices, A. Bier spoke: "I don't know any means which could be so successfully applied, besides so multilaterally, at the most various diseases". He widely practiced an artificial hyperemia, as a method of treatment of acute inflammatory diseases of soft tissue (a furuncle, an anthrax, abscesses, phlegmon) and purulent wounds, osteomyelitis and an erysipelas inflammation, eye diseases and meningitis, diseases of the central nervous system, in particular a brain, an inflammation of parotid salivary gland and lymph nodes, rigidity of joints of an inflammatory, rheumatic, traumatic and gonorrhoeal etiology, a lymphostasis and other types of hypostases, varicose expansion of veins of feet and its consequences, "menacing senile and diabetic gangrene", tuberculosis, neuralgia, a fever and other states. The impression that there is no such pathology at which treatment wouldn't try this means is made and wouldn't receive desirable result. In this regard it is quite natural to believe that any who ever tried to apply vacuum with the medical and preventive purpose in the most various branches of medicine or is engaged in it now, can consider with confidence himself it as the follower [1].

To be fair we will notice that, according to A. Bier, the artificial hyperemia isn't panacea from all troubles. He spoke: "To other can seem that I went too far. On the contrary, I don't stick to that belief that the means possessing in such degree ability to eliminate any harmful moments deserves still much bigger distribution. It is unfair to demand from one means that it cured everything; such means isn't present and won't be". Nevertheless, throughout the XX century interest to an artificial hyperemia didn't die away and periodically and with enviable constancy splashes in attention to this method were observed [1].

One more circumstance related to Bier's activity is of utmost importance. As a practical surgeon, he was fully aware that not every useful method is safe for a patient. Therefore, the scientis said that in order to prevent complications, it is necessary for the person (physician) using a remedy to "feel" it from the inside, to possess the most complete information, to know the optimal modes of usage, and to be able to adjust them. On the grounds of these assumptions, August Bier conducted tests on himself before giving recommendations on ways of application of a method or a device. Registering clearly all of the processes in his organism and following his sensations, he
studied the effect of hot air on a human; then he observed the effect of venous hyperemia achieved by elastic bandage. Similar experiments served as a basis for the plot of a famous book "Dramatic Medicine (Doctors' Experiments on Themselves)" by Prof. Hugo Glaser, the Austrian scientist [23]. In this book the behavior of Bier and his adherents is regarded as an example of selfless humanism, typical of many researchers who devoted their lives to the art of healing.

The successful usage of low dosed negative pressure in surgical treatment has contributed to the fact that this treatment got a common name "Bier's hyperemia". At that time, many studies where physicians generously shared their experience in this field were published, including the monograph by W. Meyer and V. Schmieden (1908) [24].

**Bier-Klapp's method: predecessors and successors**

Bier's ideas were inherited and further advanced by his student, R. Klapp, who developed the method successfully. One of Klapp's improvements was the following: a rubber tube connected a "dry" cupping glass to the cylinder that created vacuum in the system. After achieving the necessary level of rarefaction, the cylinder could be detached. It was not contaminated by blood and not infected, so there was no need for its frequent boiling. Another valuable suggestion was modernization of the "sucking out" device, which allowed healing contractions in knee and wrist joints [25].

Simple but ingenious technical solutions, he used to bring a device almost to perfection, which was essential for solving a specific problem.

It is appropriate to mention that at that time artificial hyperemia in organs and tissues was obtained by using special devices into which a body part was placed and then treated with hot air. Such a device was first described by Claudio (1891). Bier (1893) developed a similar device and used it extensively in his practice. Later, Krause (1898), Wilson (1899), Reitler (1900) and Roth (1902) introduced various modifications to its design. In 1898 Lindemann invented "electrotherm", which was used for raising the temperature inside a massive box by electric heating [6]. Several years later this device was modified beyond recognition. It had a capacity of combining the electric heating and vacuum gradually died away, and a method, according to some people wrote practically in all surgery guides [30]. Nevertheless, it is necessary to notice that by fortieth year's interest to vacuum gradually died away, and a method, according to some authors, S.T. Pavlov gained only historical value [31].

The method of vacuum therapy became classical. About its people wrote practically in all surgery guides [30]. Nevertheless, it is necessary to notice that by fortieth year's interest to vacuum gradually died away, and a method, according to some authors, S.T. Pavlov gained only historical value [31]. The list of references prepared by L.L. Libov and presented in final part of the monograph S.S. Girgolava "Bullet wound" (1956) is the bright confirmation for it. It includes more than one and a half thousand list of the works published in Russia, mainly, since the beginning of the first decade to the middle of the 50th years of the XX century. Only in one of them it is a question of results of treatment of wounds by Bier's method [32]. And it isn't surprising since there were antibiotics, they steel "light in darkness" on which were laid hopes. Whether it is worth complaining about functionaries from the medicine, not understanding usefulness of "a nature miracle" - vacuum when even skilled surgeons often were skeptical about it.

So, V.F. Voyno-Yasenetsky, remembering a Bier-Klapp's method in the "Sketches of purulent surgery" (1946), attached it minor significance. He wrote: "At mastitis treatment we don't apply cans. They can be considered useful only at the delimited abscess, when rather small section through which (without drainage) pus is sucked away by a Bier's can". Meanwhile, at treatment of "fresh" cases purulent tendovaginitis the authoritative expert in purulent surgery after all recommended to use a method of a stagnant hyperemia by Bier-Klapp. In the third edition of this book, left ten years later, are available very curious note of the editor professor V.I. Kolesov: "Now the
stagnant hyperemia is left" [16]. However already then vacuum therapy and together with it the low-dosed negative pressure was found by other scopes of application in surgery and other areas of medicine [33]. However, it is other history.

III. CONCLUSIONS

Against the backdrop of modern scientific achievements is a certain interest to the old and often forgotten how to treat wounds. A case in point is the use of the vacuum as a means of physical antiseptics. The centuries-old history of its use was alternating spurts of double-barreled admiration and almost complete oblivion. A momentary period of medical science and practice is characterized by attention to the way the wound. It is now of utmost importance is the need to remember the origins of the method. This is the guarantee of our success in the future.

References

[1] A.Bier, Artificial Hyperemia as the Method of Treatment [Iskustvennaya giperemiya kak metod lecheniya], Yaroslavl, 1906, 435 p. Russian
[29] E.Lexer, General Surgery [Obshchaya chirurgiya], Leningrad; 1928, T.1, 474 p. Russian

Andrey Borisovich Larichev is currently Head of the Department of General Surgery, Yaroslavl State Medical Academy, Yaroslavl, Russia.


Author of more 200 scientific papers (including 5 monographs) for the treatment of wounds and wound infection, emergency abdominal surgery, thoracoabdominal trauma and history of surgery. Prepared the 12 candidates and 2 doctors of medical sciences. Laureate of the prize of the Governor of Yaroslavl region in science and technology (1997 and 2002), the excellent health of the Russian Federation (2007).

Russia, 150000, Yaroslavl, Revolutionnaya Street 5
E-mail address: larich-ab@mail.ru