



Nikolai Sergeevich Korotkov: 120 years of his arterial blood pressure measurement method

Nikolaj Sergejevič Korotkov: 120 godina njegove metode merenja arterijskog krvnog pritiska

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Abstract

Nikolai Sergeevich Korotkov (1874–1920) was a Russian military doctor and surgeon who discovered the technique of non-invasive measurement of arterial blood pressure. Measuring arterial blood pressure is possible based on the tones recorded with a stethoscope, now known as Korotkov sounds, using a sphygmomanometer. The tones disappear when the air pressure in the cuff placed around the upper arm exceeds the systolic pressure. The appearance of the first of a total of five tones occurs after the gradual deflation of the cuff and indicates the systolic pressure. It is several millimeters of mercury higher than that obtained by palpation of the radial artery, as was determined until then. The disappearance of the last, fifth tone, with a further reduction of air pressure in the cuff, indicates the diastolic pressure. Until that moment, measuring diastolic pressure in such a painless and simple manner had not been possible. Exactly 120 years have passed since Korotkov, at only 31 years of age, first announced his discovery in 1905 in Petrograd. The method was recognized by the professional community in 1939. Since then, Korotkov's sounds have been accepted worldwide for measuring arterial blood pressure. This method has remained unsurpassed to this day.

Keywords:

blood pressure determination; history, 20th century; history of medicine; russia; surgeons.

Apstrakt

Nikolaj Sergejevič Korotkov (1874–1920) bio je ruski vojni lekar, hirurg, koji je otkrio tehniku neinvazivnog merenja arterijskog krvnog pritiska. Merenje arterijskog krvnog pritiska je moguće na osnovu tonova registrovanih stetoskopom, danas poznatih kao Korotkovljevi, uz korišćenje sfingomanometra. Tonovi nestaju kada je pritisak vazduha u manžetni postavljenoj oko nadlaktice viši od sistolnog pritiska. Pojava prvog od ukupno pet tonova javlja se posle postepenog ispuštanja vazduha i označava sistolni pritisak. On je za nekoliko milimetara živinog stuba viši od onog dobijenog palpacijom radijalne arterije, kako se do tada određivalo. Nestanak poslednjeg, petog, tona uz dalje smanjenje vazdušnog pritiska u manžetni, označava dijastolni pritisak. Njega do tog momenta nije bilo moguće meriti ovako bezbolnim i jednostavim načinom. Upravo se navršilo 120 godina od kada je Korotkov, sa svega 31 godinom života, svoje otkriće prvi put saopštio 1905. godine u Petrogradu. Metoda je prepoznata od stručne javnosti 1939. godine. Od tada su u svetu prihvaćeni Korotkovljevi tonovi za merenje arterijskog krvnog pritiska. Ova metoda je do danas ostala neprevaziđena.

Ključne reči:

krvni pritisak, merenje; istorija, 20. vek; istorija medicine; rusija; hirurzi.

Introduction

High arterial blood pressure (BP) is a common and widespread disease worldwide. It is estimated that almost a third of humanity has this health problem, which has numerous, sometimes life-threatening complications¹. In order to properly treat and control it, simple, reliable, accurate, and frequent measurements are necessary. Owing

to the discovery of a young Russian military surgeon, Nikolai Sergeevich Korotkov (Figure 1)², this has been done for more than a century.

Harold Segall was the first to conduct an intensive study of Korotkov in 1939. The first photograph of Korotkov was published quite late, in 1970. The second one was published in 1976 by Segall. He himself was involved in BP research and was very interested in the life and work of

Korotkov. In 1940, Segall wrote: “After Korotkov introduced the auscultatory method in 1905, its use became almost universal, and interest in measuring diastolic BP by any other method diminished considerably”,³.



Fig. 1 – Nikolai Sergeevich Korotkov ².
(<https://www.wikidata.org/wiki/Q918543>)

In 1939, the Joint Committee of the American Heart Association and the Cardiac Society of Great Britain and Ireland officially recognized and accepted worldwide Korotkov’s method for BP determination. Some have published translations of his original work, with the intention of reducing the great ignorance surrounding his work, despite its enormous importance in the discovery of BP measurement⁴.

Nikolai Sergeevich Korotkov

It should be noted that the biographical data of Nikolai Sergeevich Korotkov is not unique nor uniform, but differs from author to author. There are variations in the translation of the name itself: Nikolay Sergeevich Korotkov, Nicolai Sergeevich Korotkoff, and Nikolai Sergeevich Korotkov. In this paper, we used the third version.

Nikolai Sergeevich Korotkov was born on February 13, 1874, in Kursk, into an Orthodox merchant family. There, he completed primary and secondary school education with excellent results. He enrolled in the Faculty of Medicine in Kharkov (now Kharkiv, Ukraine) in 1893, where he finished one semester according to some sources⁵, while other sources mention one year⁴ or even longer. After that, he transferred to Moscow University in 1895, where he graduated with excellent grades in 1898. He was 24 years old at the time. Following this, he was appointed a resident intern at the Surgical Clinic of Moscow University under Prof. Alexander A. Bobrov, one of the preeminent surgeons. He worked there for two years, without pay. He compensated for this by working in private practice.

As a young doctor, he served voluntarily in several wars. In 1900, he was in the Far East during the Boxer

Rebellion in China. He was sent there by the University, as part of the Red Cross under the leadership of Dr. Ivan Pavlovich Aleksinsky, a former student of Prof. Bobrov. He traveled to the battlefield by the Trans-Siberian Railway and returned to Moscow *via* Japan, Singapore, Ceylon, the Suez Canal, the Mediterranean, and the Black Sea. For his “exceptionally zealous efforts in helping the sick and wounded soldiers,” he was awarded the Order of St. Anna 3rd class⁴. After returning from the war, Korotkov translated Eduard Albert’s monograph “Diagnosis in Surgery” from German into Russian.

From 1901 to 1903, he was again at Bobrov’s Clinic in Moscow as the “chief ordinator” (a senior hospital physician)⁵. In the subsequent period, from 1903, he went to Saint Petersburg, Russia, at the invitation of his colleague Sergei P. Fedorov, a surgeon, former assistant of Prof. Bobrov, who worked as a professor at the Imperial Military Medical Academy. Dr. Korotkov was appointed an instructor at the Women’s Department of the Surgical Clinic, headed by Dr. Fedorov. He worked as an unpaid doctor. Shortly thereafter, he was allowed to take his first (theoretical and practical in 1903) and second (theoretical in 1904) doctoral exams. “It should be noted that the professor who proctored Korotkov’s examination in physiology was Ivan Petrovich Pavlov, the 1904 Nobel laureate in Physiology or Medicine for studies on digestion”⁶. After these exams, he temporarily stopped working on the thesis to take care of his health, which was already deteriorating, possibly due to tuberculosis.

During the Russo-Japanese War (1904–1905), he voluntarily went to Manchuria, to the city of Harbin. There he worked as a senior surgeon for the Second Hospital Unit of the Red Cross of St. George, and then as a surgeon in the First (sometimes reported as Second) Main Hospital in Harbin, China^{5, 6}. His wife, Elena Aleseevna Grigoryeva, accompanied him on that journey as a Red Cross nurse. By the spring of 1905, they were expecting their first child.

He returned from the war to Saint Petersburg in April 1905 and continued to work on his doctoral thesis. In a brief statement in the Report of the Imperial Military Medical Academy in Saint Petersburg dated November 8, it was described how Korotkov measured the arterial BP of the wounded soldiers. The text was 281 words long⁷. In it, Dr. Korotkov described his technique for determining systolic and diastolic BP. It was entitled “On the issue of the methods for measuring blood pressure”. At the age of only 31, he presented his technique for measuring arterial BP. He himself was not aware of the significance of his discovery. He is remembered worldwide for this achievement. Exactly 120 years have passed since this highly significant discovery was made.

The following month, he published another short statement in order to experimentally support his theory. In a series of canine experiments, he demonstrated that the occurrence of tones and murmurs was of arterial, not cardiac, origin. He reported the results of these experiments at a scientific seminar on December 13⁸.

Dr. Korotkov was, first and foremost, a war surgeon and a practicing physician, not primarily a researcher. While treating wounded soldiers with arm and leg injuries, his main concern, as a wartime vascular surgeon, was to assess the adequacy of the collateral arterial circulation. He needed to find reliable clinical signs that could predict “whether the collateral blood supply was undiminished, so that the injured artery could be safely ligated when amputation was likely”⁹. Dr. Korotkov wrote: “The unpredictable results of operations are unpleasant for the physician and even more unpleasant for the patient. Therefore, it would be advisable to seek the basic signs by which it is possible to know whether the patient would be dead or alive after the ligation of the artery.”⁵ Searching for a solution to this problem, he discovered auscultatory measurement of BP. This unique method was new. Until then, the accepted method was palpation of the radial artery, which determined only systolic BP.

Both wars enabled him to collect material for his doctoral dissertation. He obtained valuable data on the diagnosis and treatment of traumatic aneurysms, collecting 44 cases of arterial aneurysms and 41 cases of arteriovenous aneurysms^{4,6}. All cases of vascular injury were thoroughly investigated, analyzed, and registered. “Korotkov’s spiritual mentor was Nikolai Ivanovich Pirogov (1810–1881), the greatest surgeon in the history of medicine and the founder of scientific war surgery”, as stated in the original text quoted here⁶.

In 1910, he defended his 150-page dissertation, entitled *Experience in determining the strength of arterial collaterals* (in Russian: *Опыт определения силы артериальных коллатералей*), in which he also briefly described BP measurement⁵.

Korotkov’s sound

In his work, Korotkov used previous discoveries such as the Riva-Rocci sphygmomanometer and a children’s stethoscope, which he placed directly below the cuff^{4,6,9}.

In 1886, the Italian physician Scipione Riva-Rocci (1863–1937) discovered, for that time, a new non-invasive method for measuring BP¹⁰. The method, still used to this day, includes a cuff placed around the middle third of the upper arm, which, when inflated, occludes blood flow in the brachial artery, accompanied by the disappearance of the pulse in the radial artery. With gradual deflation, the pulse returns, indicating the systolic BP. The cuff is connected to a mercury manometer.

Korotkov considered the tones and murmurs in the vessel to be due to compression of the brachial artery and their potential relationship with BP values. Normally, blood in the brachial artery moves in a laminar (smooth) flow, which is not audible with a stethoscope. When the air is gradually released from the cuff, due to the reduction in compression of the brachial artery, the flow becomes turbulent, which allows these tones to be heard with a stethoscope. When the brachial artery begins to decompress, after inflating to the point of complete disappearance of

sounds (complete obliteration), a pulsating blood flow is established, which generates sounds named after Korotkov, known as “Korotkov sounds”⁷.

Korotkov sounds are divided into five phases: (I) clear knock sounds are heard, at least two consecutive knocks (emergence); (II) attenuation of the knock sounds (softening); (III) return of the knock sounds, with increased sharpness and intensity (sharpening); (IV) sudden attenuation of the sounds (damping); (V) complete disappearance of all sounds⁷.

Systolic BP is when the first knock sound is heard in the stethoscope (phase I), and diastolic BP is when there is no more sound (phase V). These two phases, I and V, are therefore the determinants of systolic and diastolic BP. The systolic pressure measured this way was a few millimeters higher than the one obtained by palpation of the radial artery. Measuring the diastolic BP at that time was imprecise and challenging for researchers⁷.

This non-invasive method of measuring BP is the “gold standard”, even today. It may be at risk of being replaced by the increasing use of automated devices. This is, however, unlikely, because they must compare their algorithms, through international protocols, with arterial BP measured by the Korotkov method¹¹.

The Korotkov method is one of the most useful in diagnosing, treating, monitoring, and preventing cardiovascular diseases¹².

The rest of the biography

In 1908–1909, before defending his dissertation, Korotkov worked as a research physician in the Vitimsko-Olekminsky mining district in Siberia, where dry and very cold winters were thought to alleviate tuberculosis to some extent. He was able to return to Saint Petersburg. After defending his dissertation, he returned to Siberia as a surgeon to the workers of the Lensk gold mines (named after the Lena River, not the city of Lensk). Here, he witnessed some violence by Tsarist authorities and was deeply affected by the murder of unarmed striking miners. After this, he returned to Saint Petersburg^{4,6}. During the First World War, he served as a military surgeon at the Charitable House for disabled soldiers in Tsarskoe Selo⁴ (now the town of Pushkin), Russia. Later, after the October Revolution, he became physician-in-chief of the Mechnikov Hospital in Petrograd (renamed from Saint Petersburg). After that, he was a senior physician at the Petrograd Hospital on Zagorodny Avenue⁸. From 1913 until his death, he was in a more favorable financial situation, so he was able to devote himself to reading and painting, and even return to scientific research work.

He died prematurely on March 14, 1920, at the age of 46. It is believed that he succumbed to tuberculosis. He was buried at the Academy site in Bogoslovskoe Cemetery, Saint Petersburg. One of the streets within the Military Medical Academy, where Korotkov worked, is named after him⁶.

His wife died during the siege of Leningrad (renamed from Petrograd) in 1941. His son Sergey also followed in his

father's medical footsteps. He was a doctor, a specialist in sports medicine and rehabilitation. He died (around) 1978⁵.

There is little information available about the family of Nikolai Korotkov. This applies not only to Nikolai Sergeevich Korotkov himself, but also to his wife, son, and his son's family, whom his wife outlived⁵.

Some biographical information was published in English by Harold Segall in 1965⁶. However, due to differences between the Russian and American education systems, Segall misinterpreted certain facts of Korotkov's life⁸.

Conclusion

Nikolai Sergeevich Korotkov discovered a non-invasive method of measuring blood pressure that remains the "gold standard" to this day. Although the reasons for the interruption of his promising academic career remain unclear, his achievement at the age of 31 was truly epochal, demonstrating both the simplicity and remarkable accuracy of auscultatory measurement of systolic and diastolic blood pressure.

R E F E R E N C E S

1. Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. *Nat Rev Nephrol* 2020; 16(4): 223–37. DOI: 10.1038/s41581-019-0244-2.
2. Wikidata. Nikolay Sergeevich Korotkov. [image on the Internet]. 2025 [last edited 2025 Nov 10; cited 2025 Dec 8]. Available from: <https://www.wikidata.org/wiki/Q918543>
3. Segall HN. A note on the measurement of diastolic and systolic blood pressure by the palpation of arterial vibrations (sounds) over the brachial artery. *Can Med Assoc J* 1940; 42(4): 311–3.
4. Laher M, O'Brien E. In search of Korotkoff. *Br Med J (Clin Res Ed)* 1982; 285(6357): 1796–8. DOI: 10.1136/bmj.285.6357.1796.
5. Cantwell JD. Nicolai S. Korotkoff (1874-1920). *Clin Cardiol* 1989; 12(4): 233–5. DOI: 10.1002/clc.4960120411.
6. Samokhvalov IM, Reva VA, Fomin NF, Rasmussen TE. Contributions of the surgeon Nikolai Korotkov (1874-1920) to the management of extremity vascular injury. *J Trauma Acute Care Surg* 2016; 80(2): 341–6. DOI: 10.1097/TA.0000000000000919.
7. Campbell M, Sultan A, Shumway KR, Pillarisetty LS. Physiology, Korotkoff Sound. [updated 2023 Sep 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK539778/>
8. Sherchenko YL, Tsitlik JE. 90th anniversary of the development by Nikolai S. Korotkoff of the auscultatory method of measuring blood pressure. *Circulation* 1996; 94(2): 116–8. DOI: 10.1161/01.cir.94.2.116.
9. Estañol B, Delgado G, Borgstei J. Korotkoff sounds – the improbable also occurs. *Arq Bras Cardiol* 2013; 101(5): e99–105. DOI: 10.5935/abc.20130217.
10. Bbular KK, Singh N. From concept to cure: the life and legacy of Scipione Riva-Rocci. *Cureus* 2024; 16(9): e70436. DOI: 10.7759/cureus.70436.
11. Mancía G, Zanchetti A. One hundred years of auscultatory blood pressure: commemorating N. S. Korotkoff. *J Hypertens* 2005; 23(1): 1–2. DOI: 10.1097/00004872-200501000-00001.
12. Liu G, Li Y, Chen L, Jiang J, Tian J, Feng P. Design and validation of a novel multiple sites signal acquisition and analysis system based on pressure stimulation for human cardiovascular information. *Sci Rep* 2025; 15(1): 13392. DOI: 10.1038/s41598-025-97812-8. Erratum in: *Sci Rep* 2025; 15(1): 23534. DOI: 10.1038/s41598-025-08926-y.

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