

Clinical neurosurgery philosophy

L.B. Likhterman

N.N. Burdenko Institute of Neurosurgery, Moscow

Reveals the concept of the "philosophy of neurosurgery," including the genesis, meaning and purpose of this clinical discipline and neuroscience, basic principles, patterns of development and direction of research and treatment of neuropathology, interdisciplinary connections, the specific outlook of neurosurgeons, understanding of tools and methods for the introduction of scientific, clinical, technological and humanitarian knowledge as applied to problems of neurosurgery. Reflects on the philosophical quest of neurosurgery's founders. Demonstrates the philosophy of neurosurgery is practically implemented through clinical reasoning and conceptual approaches to surgical interventions on the brain and spinal cord. Philosophical approaches are revealed that can successfully oppose hyposkillia and doctor and patient disconnection syndrome. Demonstrates the philosophy of neurosurgery preserves the integrity of the perception of neurosurgery in the face of increasing technification and differentiation and a systematic approach to the patient.

Keywords: *philosophy of medicine, clinical reasoning, conceptual approaches, scientific knowledge, neuroimaging*

The technologizing of neurosurgery and its differentiation is associated with the threat of losing a holistic perception and systemic approach to the patient. The development of a philosophy for clinical discipline can counter this, the main purpose and significance being the treatment of neurosurgical pathology and the study of the functioning of the brain and spinal cord. The literature has only highlighted approaches to solving this problem [1].

Preamble

We shall start by trying to define the philosophy of neurosurgery and why it is needed by neurosurgeons.

The philosophy of science plays an ideological, methodological and axiological role in the development of theoretical and practical medicine. However, the philosophy of medicine, as opposed to the philosophy of science, covers the scope of human relations and their emotional components in addition to cognitive areas. Medicine should be understood not only as a profession, but as a world view. This fully applies to the philosophy of neurosurgery – a branch of the philosophy of medicine.

We are accustomed to being skeptical of philosophy and philosophizing, as though it

is a kind of abstraction. However, remember Hippocrates, ("a physician-philosopher is like God" [2, p. 97]) and the works of Galen, "the fact is that the best doctor is also a philosopher" [3, p. 71]. The great philosopher Francis Bacon stated ("medicine which is not based on a philosophy cannot be a reliable" [2, p. 84]). Martin Heidegger believed that there was a critical need for doctors to think. He stressed, "There is a place for a keen interest in philosophy everywhere" [4, p. 36].

What does it mean to philosophize when applied to neurosurgery and neurosurgeons? It means to reason and understand based on the general laws of private and individual manifestations of neurosurgical pathology. This covers the entire problem of the disease, taking into account the medical history and characteristics of the individual patient. In our opinion, it is unlikely that anyone would object to this interpretation of philosophy in neurosurgery, since every neurosurgeon, perhaps unconsciously, deals with this daily at the bedside of the patient.

When discussing the concept of the "philosophy of neurosurgery," one should understand that it is about understanding the meaning and purpose of this clinical discipline. It explains its basic principles, the study of the laws of its development, progress trends, and the role of interdisciplinary connections. It studies the specific features of the methodology and philosophy of neurosurgeons, the means and methods for understanding

scientific and technological knowledge related to problems of neurosurgery.

Currently, neurosurgery begins with a philosophical approach. Furthermore, as with any clinical discipline, it is impossible without philosophy. I.V. Davydovsky believes that medicine is entirely a philosophy. [5] In fact, the founders of neurosurgery, such as H. Cushing, N. Burdenko and K. Vincent, were philosophers.

The prominent figures of modern neurosurgery in one way or another come into contact with the philosophy of this clinical discipline. Some of them look to philosophy for the principles, methodology and basic theoretical provisions of neurosurgery. The others are philosophers in practice, developing various methods of research, diagnosis and treatment of diseases of the central nervous system (CNS). The first go from the general to the specific; the latter go from the specific to offer new fundamental approaches to neurosurgical pathology.

In 1930, N.N. Burdenko Formulated principles of neurosurgery (anatomic accessibility, physiological permissibility and technical feasibility) and although their content may vary depending on the level of our knowledge, they remain applicable today to any operation on the brain and spinal cord. This is a classic example of the philosophy of neurosurgery, going from the general to the particular.

Between 1960 and 1990, S.M. Blinkov developed a quantitative neuroanatomy and neurology [6]. He demonstrated that the number of nerve cells varies in the fully formed brains of different subjects. For example, in the nucleus of the facial nerve, it ranges from 4,000 to 16,000. This fact determines the resistance to the formation of damaging influences. The loss of up to 2000 nerve cells due to trauma or inflammation in the facial nerve nucleus does not result in any noticeable disturbance of its functions. If the number of nerve cells is minimal, then the loss of the same amount may lead to the development of paresis of facial muscles. Obviously, such a dependence refers to a philosophical category – the transformation of quantity into quality.

The invention of F. A. Serbinenko serves as an example of where specific technology gives rise to new general trends in neurosurgery [7]. The balloon catheter for reconstructive plastic

carotid-cavernous fistulae, which he developed, led to the use of minimally invasive endovascular neurosurgery with a wide range of application in cerebrovascular and medulla vascular pathology, as well as in neuro-oncology.

It is specifically the philosophy of neurosurgery that provides a systemic approach and a holistic view of the neurosurgical condition of neurosurgical patients. This is necessary when the depth of our knowledge reaches the molecular genetic level and results in a significant narrowing of the neurosurgeon's field of view. It is precisely a philosophical approach, implemented through clinical judgment, which can prevent this. The patient, suffering from individual manifestations of pathology, remains before the neurosurgeon

Philosophy is also necessary to forecast the future of neurosurgery. It allows for the appreciation and understanding of the significance and limits of the use of the specific scientific method of research, diagnosis and treatment.

The philosophy of Neurosurgery, whether we like it or not, lives in each of us, in many ways defining our daily clinical activities and professional behavior. However, an intuitive, "automated" philosophy is unaware of this. The latter determines the more productive use of philosophical approaches in clinical practice.

A philosophy of neurosurgery, of course, requires special in-depth development. Here, we will only touch upon a few of its aspects. It should be emphasized that neurosurgery has a special place among the clinical disciplines. It is the only one with the ability to experimentally study the central nervous system (CNS) of humans. Unquestionably, the main goal of surgery is to cure the neurosurgical patient and, of course, cause no harm to the patient. This could produce unique facts and knowledge that reveal the mechanisms of activity of the brain and spinal cord. Its founders, (N. N. Burdenko, C. Vincent, G. Cushing et al.) quite justifiably viewed neurosurgery as a type of neurophysiology. Under these conditions, neurosurgery acquires not only applied significance but fundamental importance as well.

Therefore, the following formulation seems reasonable: the philosophy of neurosurgery is a branch of philosophy of medicine that deals with the explanation of meaning, patterns and development trends this clinical discipline. It

reveals methods for recognizing brain pathology and its treatment, becoming the basis of the methodology of neurosurgery as a science and practice, and forming the worldview of the neurosurgeon.

Situation

Neurosurgery as an independent clinical discipline has common origins (socio-economic, natural sciences, institutional factors of formation) general rules of development (from macro-surgical to microsurgical, from minimally invasive neurosurgery and radiosurgery, differentiation and specialization of neurosurgery) and general goals (including the main one, healing patients with neurosurgical pathology). Accordingly, neurosurgery should have a philosophy that unites and explains its general principles and allows us to understand and predict the future of our discipline.

There is no doubt that all thinking neurosurgeons are philosopher by the nature of their activities, although, of course, they do not consider themselves as such. At the bedside of the ill or in the operating room, we inevitably use many philosophical categories (specifically, the good and evil that it brings patients) but are not aware of it. Moreover, the everyday neurosurgical categories, "diagnosis", "operation", "results" can be seen as philosophical: "pre-activity", "activity", "aftereffect".

The role of philosophical understanding of neurosurgery is becoming increasingly important for every neurosurgeon. It is time to move from an intuitive approach in neurosurgery to verbalized philosophical concepts.

The appearance of the collection «Philosophy of Neurological Surgery» (USA, 1995), comprised of articles written by major figures in American neurosurgery, reflects the spirit of the times. However, as acknowledged by Professor D. M. Long, a philosophy for neurosurgery has not yet been formulated [8]. He also stresses that there is essentially no philosophical traditions on which to base neurosurgery. The practice of neurosurgery is actively discussed. However, its philosophical foundations are very rarely mentioned. Additionally, the philosophy is a general theory of neurosurgery as a clinical discipline, a need that is increasing due to information and the technology explosion. The fact that the time has come to

develop issues of the philosophy of neurosurgery demonstrates the maturity of our specialty.

The time has come to explain the meanings, rules, development trends and unseen methods of knowledge and treatment of brain pathologies. A philosophy of neurosurgery is the basis for this methodology as a science and practice; it also forms the worldview of the neurosurgeon. It relies on a combination of knowledge of clinical disciplines and related sciences. A philosophy of neurosurgery is determined by the level of development of basic disciplines and simultaneously promotes an understanding and implementation of their achievements.

In our view for example, according to the methods for identifying brain damage, neuro-traumatology may be divided into three periods of development.

1. Craniological: from Hippocrates until the 1870s, when diagnostic judgments were available based only on outward signs of damage to the soft tissues of the head and skull.

2. Neurological: from the 1870s to the 1970s, when neurological signs of brain matter damage became accessible for diagnosis.

3. Neuroimaging: from the 1970s to the present, when noninvasive imaging of the brain became available.

Philosophy involuntarily permeates concepts in modern neurosurgery, for example: the doctrine of the ideal method of diagnosis, the doctrine of the phases and nature of the course of neurosurgical pathology, the doctrine of focal and diffuse brain damage, the doctrine of primary and secondary lesions of the central nervous system, the doctrine of the consequences of traumatic brain injury (TBI) and others.

Essentially, these and other concepts are philosophical, or rather clinical and philosophical. In view of this, it is worthwhile to consider the classifications constructions of neurosurgery, such as the classification of tumors of the central nervous system or the classification of injuries of the brain and spinal cord.

Components of the philosophical approach

Unquestionably, the sick and the neurosurgeon's desire to do everything possible for their healing are at the heart of the philosophy of neurosurgery.

We distinguish the following components of the neurosurgeon's objective activities: clinical, manual technology, technological, scientific, and humanistic. Together they make up a whole, a system whose name is neurosurgery, and of course, the synergy between them reinforces them. We shall consider them in order.

The clinical components of neurosurgery were the first and they remain the most important since they provide the context of the problem – the doctor and the patient. It is able to identify not only the symptoms of neurosurgical diseases, but also to adequately analyze the medical history. It takes into account the general condition of the patient, the age, psychology and social status, determining the necessary research to critically evaluate the findings, and ultimately select the best course of treatment and implement it – this is the daily goal of the neurosurgeon. It is best achieved through clinical thinking, implementing the system and, therefore, the philosophical approach towards any patient.

Based on this, we suggest that the clinical judgment of the doctor includes an analysis and synthesis of all the data about the patient (anamnesic, clinical, instrumental and laboratory). This is in contrast to their own, collegial and book knowledge, based on personal experience and intuition, establishing a systemic approach for individual diagnosis, prognosis and treatment.

Modern methods of noninvasive neuroimaging diagnosis have not only raised diagnosis to unprecedented levels, but also dramatically increased the responsibility of clinical thinking. Previously, findings were verified through observation over time, operations or sampling. In short, control had not yet reached the possibilities of corrective diagnosis. Currently clinicians receive immediate feedback.

However, the increase of tested technology of neurosurgery resulted in a crisis of clinical thinking. The hypnotized views of the neurosurgeon are too often a priority in diagnosis.

Under these circumstances, clinical dialectical judgment begins to atrophy, and the neurosurgeon loses medical viability. The skills required for a neurological examination of the patient are lost. It results in an atrophy of skills. Clinical thinking degrades and is essentially transformed into "cookie cutter" thinking.

A philosophy of neurosurgery is not only able to anticipate such situations, but also give advice on how to prevent them. From a philosophical point of view, the diagnosis is always creative. Furthermore, any instrumental methods of research are programmed to receive only given information. However, clinical judgment based on an all-embracing systemic approach allows for adequate use of all information about the patient, providing an instrumental idea of the true purpose dictating an appropriate counseling and treatment.

Here is an example. As a 16-year-old boy is taking a military entrance exam; the draft commission detects a medial echo displacement to the left by 11 mm – an alarm concerning neurosurgical danger. Usually, this is an indicator of the need for surgical intervention. To clarify the cause of the pathology and surgery, the patient was transferred to the Institute of Neurosurgery.

The young man had no complaints. Besides a significant enlargement of head circumference, no neurological symptoms were found. The talent and great diligence of the recruit was palpable. He did not waste a single moment: from morning to night, he worked hard by the bedside table, beds, and chairs; books and notebooks were neatly stacked.

However, the computer tomograms provided an image that astounded even experienced professionals. Open dropsy of the brain was expressed to a limited extent: it was practically absent in the right hemisphere, the area was filled with cerebrospinal fluid. There was a large amount of spinal fluid in the left hemisphere.

Because of this hydrocephalic background, all of the median brain structures had significantly shifted to the left. At first glance it seemed that the excess fluid had to be urgently removed from the brain, i.e., perform bypass surgery. However, comparing the computerized tomography (CT) data with the clinical picture, we came to the opposite conclusion. The boy had hydrocephalus from birth. His organism, especially his brain, had stably compensated for the pathological changes, demonstrating the surprising elastic possibilities of the nervous system. Since it was actually functioning properly, a shunt could dramatically disrupt the prevailing hydrodynamic balance and trigger a cascade of events, preventing the boy from having a full life. They decided to monitor it

and refrain from surgery. Thirty years passed. The patient successfully graduated from university and is successfully working. He was married. Our diagnosis was justified.

In neurosurgery, as in other clinical disciplines, medicine became evidence based. Undoubtedly, it enhances the overall level and quality of care for neurosurgical patients. However, sometimes treatment standards conflict with its individual effectiveness, not to mention the fact that they themselves are periodically revised. Moreover, what was recommended yesterday is today excluded from practice. A philosophical understanding of the diagnosis and treatment standards in neurosurgery allows for an understanding of their relative limitations and dynamism.

Currently, the criteria for diagnosing neurosurgical pathology is being actively developed. However, from a philosophical position it is obvious that it is as possible to use group forecasts with quite satisfactory accuracy, as it is impossible to predicting the outcome of a particular patient based on individual characteristics of the pathology.

The philosophy of neurosurgery allows for an understanding of each clinical case and helps to reveal the general laws of neurosurgical pathology.

The manual-technical component. Currently, direct or minimally invasive interventions are not only conducted manually, with the hands of a neurosurgeon, but also through the use of a great number of technical devices (surgical microscope, endoscope, navigation, neuroimaging devices, catheters, coils, stents and others). The philosophical foundations for the manual-technical component in neurosurgery are the principles formulated by N. N. Burdenko in 1930: anatomic accessibility is physiologically permissible and technically possible. Naturally, with the development of neurosurgery, each of these principles obtains new content, but they are the foundation upon which the neurosurgeon performs any surgery.

The technological component defines the growth and colossal successes of modern neurosurgery. Without any invasion, we can see almost everything that happens anatomically in the brain, from the perspective of various functional positions. Various modalities, mainly of CT and

MRI technologies have provided unprecedented breakthrough in the study and identification of CNS pathologies.

However, an adequate interpretation "image" data, the different curves, quantitative measurements and neurosurgical treatment strategy should always be based on clinical judgment.

Not only diagnostic but also actual surgical techniques have achieved tremendous advancements in modern neurosurgery. This includes microsurgery, endoscopic surgery, various reconstructive techniques, and minimally invasive functional and stereotactic surgery, including the use of robots.

Surgical procedures on the CNS are inseparable from controlled anesthesia, navigation systems, monitoring physiological functions of individual cranial nerves and functionally important areas of the brain (including waking the patient during surgery to check speech retention), intraoperative fluorescence laser spectroscopy, photodynamic therapy, and more.

Particularly productive has been the development of reconstructive neurosurgery of skull and spine using stereolithography, laser sintering and other information technologies, as well as a broad class of new xenografts.

Distant technology, such as radiotherapy and radiosurgery, is a growing field of activity and is having a great impact on the pathological formation in the brain and spinal cord.

A philosophical understanding is needed concerning the limits of its use, development prospects and relations to clinical thinking.

The technologization of neurosurgery can lead to the illusion that a machine is performing the treatment. Nevertheless, a doctor who is using all of the data of each observation methods, tools and instruments is still treating the patient.

Innovation is necessary for the development of neurosurgery. However, seemingly great ideas are often ahead of the knowledge and technology necessary for their implementation!

We shall now turn to the history of neurosurgery. The natural desire, perhaps dream, to visualize brain and spinal cord in order to detect disease before surgery became necessary has existed since the formation of neurosurgery and long before that.

The great neurosurgeon, B. Dandy, realized this first, contributing pneumoencephalography (1918) and then ventriculography (1919). It was a revolution in neuro-diagnostics. Dandy's methods quickly spread throughout the world. Indeed, based on the condition of the ventricular system and subarachnoid spaces, one could often make determinations about the presence of focal brain lesions and their topography. However, a diagnosis using pneumoencephalograms and ventriculograms was far from conclusive. The real issue was the price the patients paid! The pain, blood and trauma of the Dandy methods were poorly tolerated, with the risk of complications and even death. Non-invasive neuroimaging, Computer tomography (CT) and magnetic resonance imaging (MRI; 1970-1980) were instruments of scientific and technical mercy that allowed for the end of empirical methods that caused patients suffering. Diagnosis through suffering, invasion and blood became history.

Neurosurgery went through the traumatic macrosurgery that was prevalent, from the 1880s to 1960-1970s. Microneurosurgery, endoscopic neurosurgery and endovascular neurosurgery significantly alleviated traumatic operations on the central nervous system while at the same time dramatically increasing their efficiency and diagnosis.

Psychology also experienced severe methods of treatments, such as hypoglycemic coma, electroshock, psychosurgeries such as uncontrolled leucotomy. Fortunately, thanks to psychopharmacology, they too are a thing of the past. Here it is worth mentioning the mistakes and errors of neurotraumatology in the pre-computer era: cerebrospinal fluid transfusion, treatment of traumatic brain injury with sleep, removal of all foci of brain injury within the healthy tissue of the cerebral hemispheres.

A philosophical understanding is required to understand how this could have happened and how to prevent the potential emergence and implementation of such dangerous mistakes.

When developing and applying new methods of diagnosis and treatment, thought is given only to the effectiveness of reaching the goal; almost no attention is given to side effects such as hypothermia, even when severe. Striving to normothermia instead of hypothermia appeared

justified, since it eliminated complications specifically arising from hypothermia. From a philosophical perspective, eliminating any pathology, even a deadly agent should provide no substantial harm to the body, the brain, or to individual functions.

Current knowledge about the brain is like an iceberg. Only a small part of this supreme creation of nature is visible. Moreover, it is extremely dangerous to exaggerate the existing knowledge. For example, it is believed that a level of intracranial pressure (ICP) greater than 20 mm Hg. art. is enough to recommend the use of bifrontalno-temporal decompressive surgery. However, an increase in ICP does not disclose the true causes of cerebral failure.

Generally, an excessive increase of invasive monitoring, such as ICP in severe head injury, is associated with complications, albeit relatively rare but sometimes life threatening. When installing ICP sensors, the practice of the Institute of Neurosurgery includes monitoring for the development of subdural hematoma (requiring removal and decompressive surgery), intracerebral hematoma at the site of the sensor, and also for inflammation. Patients with severe head injuries who have had invasive monitoring of intracranial pressure may be at greater risk for the development of epileptic seizures, than those who were not subjected to intracranial pressure monitoring.

ICP sensor readings can sometimes be misleading and have dangerous consequences, showing false, clearly underestimated or overestimated values.

If we consider the mass number of sensors used in modern neurotraumatology, the idea of using this invasive procedure, associated with the use of burr holes and catheter penetration into brain matter, may be seriously questioned.

From a philosophical point of view, it is obvious that implementing the proper ideas of how to monitor such an important indicator of the intracranial environment as the pressure in the closed cavity has not yet found its noninvasive technological embodiment.

Within all of neurosurgery, there is an obvious trend towards minimizing surgical aggression; however, within individual segments, it is the opposite; it is increasing. For example,

when traumatic brain injuries unreasonably increase the indications for extensive bilateral decompressive surgery, it is rarely life-saving, but always a disfiguring operation associated with many possible early and late complications. Bilateral decompressive surgery cannot always replace something else that should be used to cure uncontrollable intracranial hypertension. Sometimes, despite extensive bilateral decompressive surgery, intracranial pressure continues to increase, leading to death.

This was one of the observations of the Institute of Neurosurgery. Patient P was 43 years old. He had suffered multiple skull fractures and severe brain injuries as a result of a concrete pillar falling on his head. On the 7th day after the injury, there was an increase in pressure to 25-30 mm Hg. art. Antihypertensive therapy – hyperosmolar solutions, hypothermia and moderate hyperventilation were ineffective. Deep clinical torpor turned into a coma. According to the CAT scan, there as a damaged foci (on the right frontal lobe convex, in both sections of the mediobasal frontal lobes, the right temporal lobe pole), and subarachnoid hemorrhage, revealing a diffuse swelling of brain matter and compression of its ventricles and basal cisterns. The doctor on duty decided to immediately perform a bi-frontal temporal decompressive craniotomy. Despite surgery, intracranial pressure rose to 46-53 mm Hg. art. It worsened to a terminal coma. Three days after the bilateral decompression for uncontrollable intracranial hypertension, the patient died.

Thus, extensive decompression does not always result in the elimination of intracranial hypertension.

A review article by S. Sener, B. Roozenbeek and A. Maas [9] noted that the enthusiasm for the effectiveness of decompressive craniotomy was halted due to the unexpected results of their analysis of the multicenter prospective randomized study of DECRA. It turned out that the diffuse axonal injury of the patient's brain was adversely affected by the bi-frontal craniotomy [10]. Decompressive craniotomy was associated with a high proportion (50%) of complications. Therefore, according to P. B. Seung and coauthors, among 89 patients who underwent decompressive craniotomies, in 32.6% of the cases there was

subdural accumulations observed; in 14.6% there were external protrusion of the brain with venous infarction; in 11.2% there was hydrocephalus; in 5.6% there was delayed hematoma; in 4.5% of cases there was intracranial infection [11].

Patients who survived extensive decompressive surgery developed trepan complications and all required complex cranioplasty.

Clearly, there is a need for less traumatic methods of dealing with threatening and uncontrollable intracranial hypertension.

The technological feasibility of radical removal of focal lesions of the central nervous system has increased dramatically. Nevertheless, it should always be weighed against clinical prudence, based on the patient's quality of life. For example, total removal of a large acoustic neuroma may lead to paralysis of the facial nerve. At the same time, their subtotal removal returns the patient to a normal life, but without disfiguring lesions of the facial nerve function (albeit with a certain risk of tumor recurrence in years). Which is better is a philosophical yet practical issue.

The scientific term “neurosurgery” has a special place in this philosophy. The possibilities inherent only in neurosurgery, for direct and indirect study of the human brain in the provision of medical care, imposes on the neurosurgeon the responsibility for obtaining new knowledge on the interactions of the central nervous system, its functional and anatomical relations in normal and pathological conditions.

We must distinguish and study not only the mechanisms of the pathogenesis of disease, but the mechanisms sanogenesis – the cure. It is precisely philosophically based approaches to different sides of the same pathology that allows us to find new solutions in clinical practice.

For example, a study at the Institute of Neurosurgery on the pathogenesis and sanogenesis of chronic subdural hematomas showed that the primary reason for their occurrence was the existence of hyperfibrinolysis content hematoma (due to the accumulation of fibrin degradation products). If this were so, then instead of a large traumatic surgery such as a craniotomy and removal of the hematoma and capsule, it would be sufficient to change the internal matter through a small opening in order to start the process sanogenesis. In fact, along with a sharp decline

of deaths and complications, in the course of 2-3 months there was a complete resorption of the hematoma and capsule, as confirmed by MRI or CAT scans and, of course, the patients were cured.

Within the framework of the scientific components of the philosophy of neurosurgery, there must be a development of the concepts of "the severity of brain damage" and "serious condition of the patient". The relationship between them is not always observed. For example, when verifying the severity of a frontal lobe injury (injury severity substrate) using a CAT scan or MRI, the clinical condition of a patient may be perceived as satisfactory by indicators such as the level of consciousness, focal, stem and overall body symptoms.

Such "vectors" are often observed in chronic subdural hematomas, when their enormous volume and the displacement of midline structures reaches a critical value, even when the patient conditions remain satisfactory.

The issue of the clinical phase of the neurosurgical pathology and compensation of cerebral functions is useful in revealing the philosophical positions for the entire organism.

A formulation of research questions and suggested hypotheses in neurosurgery always require a systemic analysis that considers all interacting and countervailing factors during implementation.

Humanistic component. The philosophical approach to the patient, as a suffering individual, must resist technology and the treatment of a disease without considering the individual characteristics of the patient, who defines the features of the clinical manifestations of the disease and the deployment of compensatory processes relevant to the illness. The fact is that the sick person is not reducible to the illness, no matter how significant or even fatal it is for the person.

Neurosurgery, naturally, has become important for the visualization of pathologies of the nervous system, which defines diagnosis much more than it communicates with the patient. This inevitably ignores not only the personal qualities of the person, but also harms him clinically and psychologically. Often, there is a dangerous separation syndrome between the doctor and the patient.

Medical science is primarily involved in the study of indicators and substrata of disease and it has achieved great success. There is an artificial partition between the patient and the carrier of the disease; the individual receives almost no attention. However, the neurosurgeon should always remember that the operation is on the patient, not the image. The role of humanistic principles in neurosurgery should not only be level with the development of high technology, but also surpass it.

Modern neurosurgery has accumulated many contradictions, such as the sanctity of life and the quality of life, the professional duty of the doctor and commercial temptations, common sense and scientific knowledge, life-saving and organ transplantation, extensive technical capacity and limited financial resources. Professional philosophers can contribute in resolving them in the interests of the patient.

A humanistic philosophical approach in neurosurgery is closely connected with such important concepts as "quality of life". Thanks to advances in modern neurosurgery, patient mortality has fallen sharply. For example, the Institute of Neurosurgery N. N. Burdenko in 2013 performed 7087 major surgeries on the brain and spinal cord and deaths amounted to 0.99%. Therefore, there has been a paradigm shift in neurosurgery when assessing the results of patient treatment; it is not survivors and death but the quality of life of the patients. It is precisely on this basis that we should decide on surgical intervention. Saving lives at a vegetative status that have a minimum level of consciousness and severe disability is not humane for the patient, his family or society. The criteria for measuring the good or evil of a neurosurgeon's activities should be based on an acceptable quality of life for the patients operated on.

Perhaps particularly relevant would be the development of philosophy in a new direction, such as preventive neurosurgery.

No matter how well intentioned the motives may be, if they threaten the basic principle of medicine – "do no harm", then they should not be implemented. Therefore, the preventive neurosurgery required under new conditions of diagnosis and treatment should avoid the sad fate of a universal approach to the problem. It desperately

needs to develop a specific philosophy and methodology that must reflect the neurosurgeons who have decided to use it. Only a philosophical understanding allows a physician to see the healthy person behind the picture, see the threat to the patient's future, and decide whether the patient needs assistance or not, and if so, when and how.

Neurosurgeons involved in preventative treatment cannot but help being philosophers. They have to deal with such philosophical categories as life and death, good and evil. We emphasize that when penetrating an unhealthy brain during the preclinical period they are forced to (and not just professionally) question how to treat their patients: whether it will provide them a healthy future (i.e. bring good) or condemn them to suffering (i.e., will bring evil, though against the wishes of the neurosurgeon). If the preventative diagnosis for neurosurgery can only rely on the "image" then the tactical decision – "to act or not to act" – should be only clinically philosophical.

The best way to understand the components for neurosurgery in practice is through clinical reasoning and conceptual therapeutic decisions, systemically implemented, taking a philosophical approach to any patient.

Based on the results of our studies, a hierarchy and interrelationship is formed in the tree of "philosophy of neurosurgery" (Figure).

Medical empathy, neurology and diagnostic technologies collectively underpin clinical thinking. They serve detection, treatment strategy and prognosis. Pathogenesis and sanogenesis of neurosurgical pathology, along with surgical technologies, define the conceptual approaches to treatment. This determines the conceptual approach to individual patient goals, methods of surgery and most importantly – results. The image of clinical reasoning and conceptual approaches may be seen as wings on which the practical philosophy of neurosurgery maneuvers and moves. Additionally, it is philosophy that influences the development and application of all the components of diagnostic and therapeutic combinations of neurosurgery.

Conclusions

The trends integrating medicine in the XXI century are based on systems theory, computer science, evolutionary, ecological, and other

synergistic ideas, principles and methods most accurately perceived, and then successfully used through a scientific philosophical outlook and methodology.

Philosophical culture allows the physician to overcome bias in the study of problems for increasingly highly specialized scientific and practical activities.

Let us try to articulate why a philosophy of neurosurgery is needed:

- to prevent the breakup of neurosurgery into subspecialties and maintain it as a single clinical discipline;
- to maintain and develop a neurosurgeon's clinical thinking, so as not to be solely dependent on technology;
- so that in practice, neurosurgeons will always proceed from the dilemma: will they bring the patient good or evil;
- to combine the three main components of neurosurgery as a clinical discipline and neuroscience – education, research and practice neurosurgeon;
- to anticipate the evolution of neurosurgery and assimilate it properly, reinforcing a positive start and mitigating the negative aspects of progress.

The lack of philosophical training, long needed in practical neurosurgery, is felt more sharply than the lack of high technology.

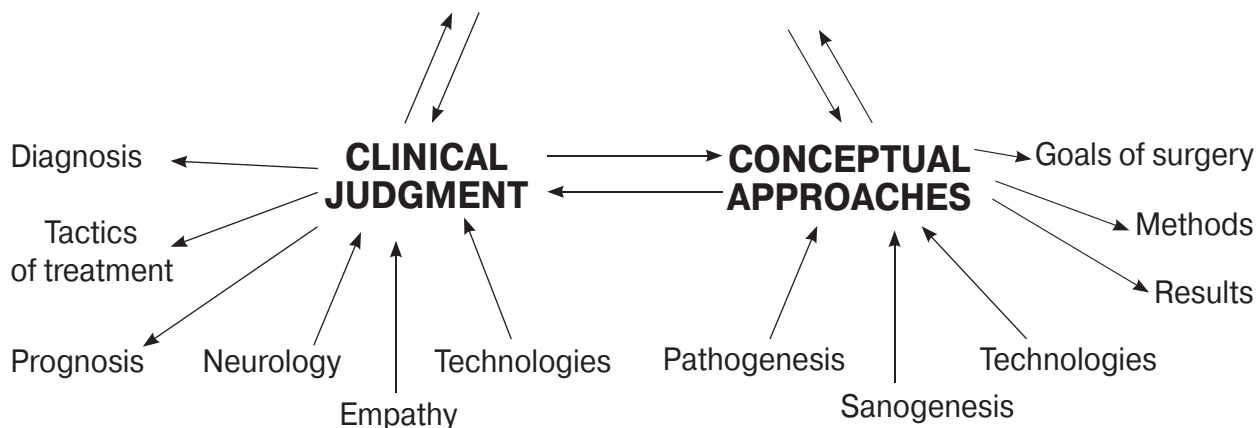
The philosophy of neurosurgery is a reliable antidote:

- against an atrophy of clinical thinking and addiction to technology;
- against a loss of neurological examination skills (hypo-skills) and an exclusively "image" diagnosis;
- against a disconnection syndrome between patients and doctor that ignores the individual patient.

The range of effects on neurosurgical pathology is constantly expanding. Additionally, there is a natural lessening of macro surgery, traumatic and bloody approaches, making it a gentler and more effective method, with an increasing proportion of minimally invasive and distant methods of healing.

Based on the intensity of leading world research, one may foresee the coming of the next period in the development of neurosurgery –

PHILOSOPHY OF NEUROSURGERY



The hierarchy and interactions between clinical thinking and conceptual decisions (the tree of neurosurgical philosophy).

cellular and molecular genetics that will change the methodology of this discipline. Methods of genetically engineered stem cell transplants, electronic prosthetics for lost functions such as sight, hearing and smell will receive widespread use.

Furthermore, it is obvious that neurosurgery, as it is commonly understood, will remain and will continue to actively develop, primarily in relation to severe traumatic brain injury and associated trauma, for reconstructive operations, including deformities of the skull and spine. There will be development in preventive neurosurgery, including for the newborn, and fetal brain surgery aimed at correcting congenital abnormalities in utero.

In view of the increasing rate of technological development in neurological diagnosis and treatment, it is extremely important to have a philosophical understanding of current processes with a critical evaluation of all aspects, including even minimal future risks, such as, even the rare possibility of inducing blastomatic effects when using CAT scans [12].

The development of neurosurgery and the widespread use of high technology and economic

factors increasingly require philosophical approaches for solving everyday practical problems. Therefore, the neurosurgeon should be methodologically and ideologically educated and not become a "cog" of modern neurosurgical science and practice, remaining a humane and thoughtful doctor. The philosophy neurosurgery is not detached from reality, but a path to mastering these laws of reality by knowing the patterns of its development.

Philosophy joins all levels of our knowledge of pathology. Its causes, epidemiology, holistic (organism), organ, tissue, cellular, subcellular, molecular and genetic, connecting them with environmental factors (including the universe) and society.

The philosophy neurosurgery needs to oppose technological mechanistic interpretations for diagnosis and treatment of diseases of the central nervous system and should be used with clinical judgment at the bedside of each patient. One should bear in mind that the productivity of philosophy is not in specific prescriptions, but in providing the neurosurgeon a systemic outlook and an intellectual and moral capacity to make appropriate decisions.

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About the author

Likhterman L.B. – Doctor of Medical Sciences, Professor, Chief Researcher, N.N. Burdenko Neurosurgery Institute (Moscow).

E-mail: lichterman@hotmail.com

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