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Bioethical Aspects of Robotics in Surgery**

ABSTRACT

The article discusses the bioethical aspects of robotics in surgery and assesses the impact of this process on the relationship between the physician and the patient. An engineering model is gradually replacing the traditional paternalistic model of the physician-patient relationship. If paternalism implies the doctor's attitude to the patient as his sick child, which requires compassion, help, and great responsibility on the part of the doctor, then when implementing the second model, the doctor, like a technical executor, performs only the responsibilities provided by the job description. On the one hand, the dominance of a technical-type model carries the threat of depersonalizing the patient and eliminating contact between the physician and the patient. On the other hand, this contributes to a radical change in the concept of medicine. Why people usually go to doctors? For establishing a diagnosis, prescribing a course of treatment, a prescription, and performing medical manipulations? Machines, leaving a human with a completely different role in the relationship between the physician and the patient, will increasingly perform these actions. The release of doctors from routine tasks will allow them to pay more attention to patient care, fully demonstrating their human qualities. The article analyzes the surgeon's place in modern medicine and makes an attempt to determine which category the surgery belongs to, "machine territory" or "human territory".

Keywords: bioethics, artificial intelligence, robotics, automation, concern, Dasein.

1. Introduction

Over the past 20 years, medicine has seen rapid growth in robotics, leading to the automation of many processes and, as a result, to the transformation of traditional relationships between a doctor and a patient. Between the physician and the patient,

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an intermediary appears in the form of a technical device. The diagnosis at present is the sum of objective studies (blood, urine, ECG, ultrasound, MRI, CT, etc.). Since the time of Hippocrates, paternalism has been adopted in medicine - the doctor's attitude to the patient as his sick child, which requires compassion, help, and great responsibility on the part of the doctor. "In this model the physician-patient interaction ensures that patients receive the interventions that best promote their health and well-being".[1] In recent decades, according to R. Veatch, this traditional model of physician-patient relationship has been gradually replaced by an engineering model that has arisen because of the biological revolution, which promotes the spread of the type of an impartial doctor-scientist who must rely on facts, avoiding value judgments. When implementing this model, the doctor treats the patient as a broken machine, and he becomes a technician who cleans the clogged body systems. "It would make him an engineer, a plumber making repairs, connecting tubes and flushing out clogged systems, with no questions asked".[1] The dominance of a technical-type model can lead to the further depersonalization of the patient and to the elimination of contact between the physician and the patient and, as a result, to the replacement of most doctors with AI systems and robots.

2. Surgical robots

In recent years, mechanical devices have begun to occupy the space between the surgeon's hand and the patient's body, replacing tactile contact with visual cues to complete the procedure. In fact, over the past two decades, the surgery process is being replaced with new technologies, including computer surgery, advanced imaging technology and the use of robotic systems to ensure the accuracy of the surgical procedure.

The problems of providing traditional surgical care are associated with insufficient dexterity and accuracy of the human hand, a low degree of visualization of the surgical field, as well as a high risk of injury to patients. These problems can now be solved with the help of robots. "Robotic surgery applies actuators and computer control into all surgical specialties with an overarching aim to combine a minimally invasive approach with improved surgical precision and accuracy"[2]. Therefore, the operations performed by the Da Vinci robot (USA) are an effective low-traumatic and highly accurate surgical intervention performed by a remote method on various organs: prostate, heart, kidneys, lungs, liver, and stomach. A doctor from the console controls

1 Veatch, Robert M. (1972), Models for Medicine in a Revolutionary Age, *Hastings Center Report*, 2 (3), 5-7.

2 Ashrafian, Hutan, Clancy, Olivia, Grover, Vimal, Darzi, Atefe (2017), The evolution of robotic surgery: surgical and anaesthetic aspects, *British Journal of Anaesthesia*, 119 (1), i72–i84. DOI: https://doi.org/10.1093/bja/aex383.

robotic manipulators equipped with sensors, a video system, and various tools. The advantages of this technology include low blood loss; reduced chance of infection; the use of fewer anesthetic medications; short rehabilitation period; minimal damage to tissue integrity; decrease in load on the body; minor pain[3]. However, the Da Vinci robot also has its drawbacks: the lack of tactile feedback, which is so important for the surgeon when working with body tissues; high cost (from $ 1 million). To this should be added a small number of experienced surgeons capable of operating with it. It should be said that not all patients are satisfied with the result of the robot, but their complaints are most often related to the qualifications of the specialist who performed the operation. In some cases of surgical pathology, a robotic operation shows the same complications as laparoscopic, i.e., it is not better, but only more expensive. There is no documented evidence that robot-assisted surgery, at its increased cost, achieves significantly better results.[4] A Japanese researcher K. Nishimura confirms that it will be necessary to check the superiority of results and the balance of costs and benefits when using a Da Vinci robot compared to conventional laparoscopic surgery. "Despite the potential advantages of robotic use, robotic surgery will have a tough road to be utilized for a wide range of surgical treatments without a downward price revision of the robotic equipment"[5].

Currently, the manipulators are controlled by doctors who are ready to assist the patient if there is any malfunction in the robot's operation mechanism. However, the more doctors rely on machines, freeing themselves from mental and physical efforts, the faster they lose their valuable professional and specialized skills. In this regard, a whole range of problems arises: from confidence in technology for perfect work to the emotional distance between the patient and the surgeon[6].

3 Hussain, Azhar, Malik, Amina, Halim, Mohammed U., Ali, Aslankhani Mohammad (2014), The use of robotics in surgery: a review, *The International Journal of Clinical Practice*, 1376-1382.; Intuitive Surgical (2014), *2014 Annual Report - Annual Report Pursuant to Section 13 or 15(D) of the Securities Exchange Act of 1934, Sunnyvale, CA*; Intuitive Surgical, Inc. http://annualreports.com/HostedData/AnnualReportArchive/i/NASDAQ_ISRG_2014.pdf (accessed: 20 December 2019).; Reza, Mohammadian, Maeso, Sergio, Blasco, Antonio J., Andradas, Elena (2010), Meta-analysis of observational studies on the safety and effectiveness of robotic gynaecological surgery, *British Journal of Surgery,* 1772-1783.

4 Wright, Jason, Ananth, Cande V, Lewin, Sharyn N., Burke William L. M., Lu, Yu-Shiang, Neugut, Alfred I., Herzog, Thomas J., Hershman, Dawn L. (2013), Robotically assisted vs laparoscopic hysterectomy among women with benign gynecologic disease, *JAMA*, 689-698.

5 Nishimura, Kazuo (2015), Current status of robotic surgery in Japan, *Korean Journal of Urology*, 170–178. DOI: 10.4111/kju.2015.56.3.170.

6 Bass, Barbara (2019), *Robotics and Computational Surgery*, www.academyforlife.va/content/dam/pav/documenti%20pdf/2019/Assemblea2019/TestiRelatoriPubblicati/FT%20Bass.pdf (accessed: 20 December 2019).; O'Sullivan, Shane, Nevejans, Nathalie, Allen, Colin, Blyth, Andrew, Leonard, Simon, Pagallo, Ugo, Holzinger , Katharina, Holzinger, Andreas, Ashrafian, Hutan (2019), Legal, regulatory, and ethical frameworks for development of standards in artificial intelligence (AI) and autonomous robotic surgery, *The International Journal of Medical Robotics and Computer Assisted Surgery,* e1968. DOI: 10.1002/rcs.1968.

Meanwhile, autonomous robots have already been used in medicine – Smart Tissue Autonomous Robot (STAR). Soft tissue surgery is difficult even for experienced surgery - you have to work with soft and pliable material. The edges of the material are uneven, and it is very difficult to choose the best point for threading the needle on each seam. STAR was able to perform an operation to impose an intestinal anastomosis (the connection of two tubular sections of the intestine). When stitching such seams, it is important to observe clear gaps between the seams and not to stretch the thread too much. The assistant man only helped to straighten the thread so that it would not be tangled when it was stretched through the fabric. As a result, the seam was laid by the robot smoother and more accurately than an experienced surgeon does[7]. "The possibility of greater automation is already raising questions about how the surgeon's role will evolve if intelligent robots take over the trickiest maneuvers. Most in the field still see a place for surgeons — although they will need to become consummate managers, proving their skill not just at specific procedures, but at using an array of automated tools to best effect".[8]

In 2019, a remote brain operation using the 5G format was successfully performed in China: a doctor implanted a brain electrical stimulator for a patient suffering from Parkinson's disease. Ling Zhipei, a neurosurgeon in Hainan, performed the operation while the patient was in Beijing. The situation in the operating room was projected on a high-resolution monitor using the 5G format; the doctor remotely controlled surgical instruments using telepresence technology.[9]

As the American researcher B. Bass rightly noted, the essence of the surgery process is that it implies personal interaction between the doctor and the patient. "One human being, the patient, with a body in need of an intervention – a repair of an injured or failing part, removal of an infected or invasive element, or at times a replacement of a failed organ - seeks the help of another, a skilled and knowledgeable stranger, a surgeon. That surgeon uses his or her hands and tools, coupled to skills, knowledge, wisdom and experience, to affect the remedy, the invasive operation with inherent risks and benefits… The human trust in this experience is remarkable; both for the surgeon who inherently causes harm with the intervention and relies on the patient's body to heal, and for the patient. This would seem to be the most uniquely of human

7 Shademan, Azad, Decker, Ryan S., Opfermann, Justin D., Léonard, Simon, Krieger, Axel, Kim, Peter C.W. (2016), Supervised autonomous robotic soft tissue surgery, *Science Translational Medicine*, 8, 337. DOI: 10.1126/scitranslmed.aad9398.

8 Svoboda, Elizabeth (2019), Your robot surgeon will see you now. Autonomous systems are beginning to equal human specialists at precision surgical tasks, *Nature*, 110-111. DOI: 10.1038/d41586-019-02874-0.

9 Loeffler, John, *China Performs Country's First-Ever 5G Remote Brain Surgery*, https://interestingengineering.com/china-performs-countrys-first-ever-5g-remote-brain-surgery (accessed: 20 December 2019).

expressions of trust"[10]. Thus, surgery is a unique expression of trust between people, which is leveled by the mediation of robotic systems.

In connection with the development of robotic technology, which one day will lead to the widespread use of intelligent assistants, we are faced with new ethical problems, such as replacing many surgeons with robots and losing their jobs; lack of emotional connection between the doctor and the patient; a decrease in the doctor's responsibility and the loss of specialized skills by doctors. The research center of the Superjob portal found out how representatives of various professional groups evaluate the prospects for automating their work. "21% of doctors believe that doctors will soon be replaced by robots. Computerized diagnostic methods, robotic surgery, medical devices and sensors-this is not the future, but the present of medicine"[11]. An important issue is the emotional impact of the robot on the patient. The question remains unanswered; can the robot respond effectively if necessary to provide the patient with emergency care?

In Russia, people are wary of robots in some areas of their use, as evidenced by population surveys. Therefore, in the fall of 2019, the Higher School of Economics published the results of another survey of Russians about their attitude to robots. More than 7.5 thousand respondents aged 18 to 65 years attended the survey. Participants were asked to rate several hypothetical situations involving robots, which they rated in terms of comfort. It turned out that 66% of the respondents are ready for the robot assistant to help with household chores. 62% will calmly accept if the drone brings their purchases from the store. 53% will be able to entrust the solution of legal issues to the consultant robot. All other situations did not receive approval from half of the respondents. 73% of respondents are not ready to get into a car that will be driven by Artificial Intelligence. The most uncomfortable situations were those in which the robot takes care of the elderly parents, performs a medical operation, or is engaged in raising children.

According to experts, this result is because, in convenient cases, the robot obeys the will of man, and in inconvenient cases, people are already dependent on artificial intelligence. "In the first case, the actions of the robot are subject to the will of the user, and all decisions are ultimately made by the person. In the second - the robot

10 Bass, Barbara (2019), www.academyforlife.va/content/dam/pav/documenti%20pdf/2019/Assemblea2019/TestiRelatoriPubblicati/FT%20Bass.pdf.

11 Superjob portal research center (2016), *The fact that their work will soon be performed by robots, call center operators are most confident, teachers and nurses are the least*, https://www.superjob.ru/research/articles/112015/v-tom/ (accessed: 5 June 2020).

is already acting as the subject of action, which is unusual and uncomfortable for most people".[12]

3. Surgery: "machine territory" or "human territory"?

In connection with the further development of robotics and digitalization in the field of healthcare, can we say that surgery belongs to the category of "machine territory"? In the article by F. Vossen and A. Zogner, "The Future of Labor: The Destructive and Transformational Effects of Digitalization," it is noted that digital technology, in general, has a transforming effect, not a destructive one. "The destructive effects are expressed in the replacement of human resources with machines, and the transforming ones are in increasing the productivity of people,"[13] these researchers write. At the same time, these two effects weakly affect professions related to "human territory". In my opinion, modern medicine simultaneously falls into two categories: "territory of machines" and "human territory". Medicine refers to the "territory of machines" by virtue of the automation of many processes (control of the main indicators of the body's work, diagnosis, robot-assisted operations).

According to a study by Vossen and Zogner, for doctors, primarily for surgeons, the magnitude of the effect of transforming digitalization exceeds the median value by more than three standard deviations. The transformative impact of digitalization here implies a closer interaction between humans and machines. However, despite the large-scale transformation, medical activity is unlikely to lose demand since the risk of destructive effects for it is below the average.

Currently, there is a growing demand for skills in using digital technologies and competencies inaccessible to machines. Three areas of skills less accessible to machines are distinguished in the work of Frey, Osborne.[14] These are perception and manipulation skills; creativity and social intelligence. These skills are inaccessible to the computer. Thus, perception and manipulation include manual dexterity (although, according to the skills, machines are becoming better mastered). Creative intelligence is the ability to offer original ideas in certain situations. Social intelligence is based on social receptivity, the ability to negotiate, the ability to persuade and care for others. Obviously, social intelligence implies empathy, the ability to unite people and overcome disagreements, the ability to convince others of a change in

12 Polyakova, Valentina, *The population's perception of interaction with robots,* https://issek.hse.ru/news/302682265.html (accessed: 20 December 2019).

13 Vossen, Frank M., Zogner, Alina (2019), The Future of Labor: the destructive and transformational effects of digitalization, *Foresight*, 13 (2), 10.

14 Frey, Carl B., Osborne Michael A. (2017), The Future of Employment: How Susceptible Are Jobs to Computerization? *Technological Forecasting and Social Change*, 114, 254-280.

their opinion or behavior, and that they need personal or medical help, in particular, colleagues, clients, and patients. "Professions from the "human territory" category require enhanced skills for caring for others and the ability to work in confined spaces..." [15]

Thus, as we see, one of the key skills related to the "human territory" is caring for others, which is necessary in medicine.

The term concern is used in many senses: a feeling of worry usually shared by many people, a feeling of being interested in and caring about a person or thing, something that is regarded as important, something that a person is responsible for or involved in (learnersdictionary.com)[16]. These concepts indicate a person's willingness to do good, his responsiveness, and empathy for others. In German philosophy, especially in existentialism, the term 'Besorgen' (translation, 'concern') has a universal meaning. The existentialist M. Heidegger, who recognized it as the main mode of human existence, first considered the concern. Heidegger writes, "... being-in-the-world is in essence a concern ..."[17] Caring (about oneself, about another, about society, about space and time) is a way of human interaction with the world in its wholeness and therefore has an ontological status.

Concern determines the very essence of man and refers to "Dasein" (here-being). "Dasein" is intentional, can only be directed outwardly. Therefore, the existence of care is directed more likely not at ourselves, but at others. Caring is the opposite of apathy and includes awareness, desire, compassion and anxiety, feelings of love and guilt, recognition for the "other" is no less valuable and important than for itself. If a person does not care, he loses his essence. "If you imagine it fully, then the structure of care includes the phenomenon of "I".[18] Caring guarantees the constancy of the "I". Caring is also a source of will. Expression of will is "a care that has been set free and has become active".[19]

In the near future, intelligent machines and robotic systems will surpass the doctor in diagnosing diseases, in the accuracy of performing surgical operations. Still, they can never replace the doctor in taking care of the patient.

In March 1927, Dr. F. Peabody delivered a lecture to the students at Harvard University in the most widespread American journal for JAMA doctors. In this

15 Vossen, Frank M., Zogner, Alina (2019), 15.

16 Learner's Dictionary (2020), *Concern*, https://learnersdictionary.com/definition/concern (accessed: 5 June 2020).

17 Heidegger, Martin (2011), *Being and time/lane with him*, Academic Project, 100.

18 Ibid, 370.

19 Macquarrie, John (1967), *Will and Existence. The Concept of Willing*, New York; Abingdon Press, 103.

lecture, Peabody noted that the practice of medicine, which is an art, involves the whole relationship between the physician and the patient. The art of healing is based on the medical sciences but incorporates much of what is beyond science. The art of healing and the science of medicine should not contradict each other but should complement each other.

A good doctor knows his patient through and through but pays dearly for this knowledge. "You have to generously spend time, sympathy and understanding," Peabody writes, "but the reward for this is a close personal relationship with the patient, which gives the greatest satisfaction in medical practice. One of the most essential qualities of a clinician is his interest in people, because the secret of healing is to take care of a sick person".[20]

4. From a survey of Russian surgeons about attitudes towards robots

In June 2019, I conducted a survey of 10 practicing surgeons of various specializations about their attitude to robots. Most of them expressed skepticism, noting the loss of direct contact with the patient's tissues during surgery, the inability of the robot to respond adequately in an emergency, as well as concerns about job losses. Here are the words of a pediatric surgeon operating on newborns: "I am skeptical and negative about the introduction of robots in surgical practice. Firstly, it means less job for humans. Secondly, direct contact with the patient during the operation is lost, the role of the surgeon is to some extent excluded, and there is no sense of touch. Thirdly, given the practice, quite often, there are unique or emergency cases (in any case in children's practice) that require an immediate reaction (just press a blood vessel with your finger). Sometimes the surgeon's tactics are built intraoperatively based on palpation of organs, any formations, and determination of their consistency, which is more reliably determined precisely by direct contact."

Moreover, here are the words of the trauma surgeon: "In medicine, the human factor occupies a huge place; the device can interrupt and perform an operation not in accordance with the standard, which leads to fatal consequences for the patient". One oncologist surgeon has noted: "I need to feel the tissue on which I work." The dentist surgeon said: "Sometimes you can feel a lot about the patient, and the patient can feel something about you. There must be some kind of human contact between the doctor and the patient. Sometimes the patient may get scared, twitch during

20 Peabody, Francis W. (1927), The Care of the Patient, *JAMA*, 88,877-882.

the operation, and the doctor can calm him and change the direction of his hands. Machine, a robot cannot do this".

5. Conclusion

The concept of medicine is radically changing now. Why do people usually go to doctors - to establish a diagnosis, prescribe a course of treatment, write a prescription and perform medical procedures. These tasks more and more often will be performed by machines, leaving a person with a completely different role in the relationship between doctor and patient. Relieving doctors from the difficult task of comparing a huge amount of data to diagnose diseases and perform routine interventions should allow them to pay more attention to patient care, that is, to demonstrate their human qualities and soft skills. It is known that the success of treatment depends on 60% of the patient's confidence in the doctor, which shows the need for feedback in medicine.

The state of the patient's psyche greatly affects the course of the disease. The doctor's task is to form the patient's hope of recovery. Voyno-Yasenetsky: "Psychotherapy, consisting of the verbal, or rather, spiritual influence of a doctor on a patient, is generally recognized, often giving excellent results in the treatment of many diseases".[21]

Thus, it is impossible to replace the unique human interactions between the surgeon and the patient with a robotic counterpart. Surgeons should use the robot only as a tool for operations. Responsibility for the operation should be borne by the surgeon, who controls the robot and controls its manipulation. The surgeon is also required to accompany the patient both before and after the operation, taking care of him and inspiring confidence.

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Bioetički aspekti robotike u kirurgiji

SAŽETAK

Članak raspravlja o bioetičkim aspektima robotike u kirurgiji i procjenjuje utjecaj tog procesa na odnos između liječnika i pacijenta. Inženjerski model postupno zamjenjuje tradicionalni paternalistički model odnosa liječnika i pacijenta. Ako paternalizam podrazumijeva odnos liječnika prema pacijentu kao prema bolesnom djetetu, što zahtijeva suosjećanje, pomoć i veliku odgovornost liječnika, tada prilikom primjene drugog modela liječnik, poput tehničkog izvršitelja, ima samo odgovornosti predviđene opisom posla. S jedne strane, dominacija tehničkog modela nosi prijetnju depersonalizacije pacijenta i uklanjanja kontakta između liječnika i pacijenta. S druge strane, to pridonosi radikalnoj promjeni koncepta medicine. Zašto ljudi obično idu liječnicima? Za utvrđivanje dijagnoze, propisivanje liječenja, radi terapije i obavljanja medicinskih tretmana? Roboti će, ostavljajući čovjeku potpuno drugačiju ulogu u odnosu između liječnika i pacijenta, sve više izvoditi te radnje. Oslobađanje liječnika od rutinskih zadataka omogućit će im da posvete više pažnje skrbi o pacijentima, u potpunosti pokazujući svoje ljudske osobine. Članak analizira mjesto kirurga u modernoj medicini i pokušava utvrditi kojoj kategoriji kirurgija pripada, "području stroja" ili "području čovjeka".

Ključne riječi: bioetika, umjetna inteligencija, robotika, automatizacija, briga, *Dasein*.