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ROBOETHICS: BIOETHICAL ASPECTS OF ROBOTIC SURGERY[1]

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Abstract: Nowadays, the use of robots in surgical procedures and in rehabilitation processes is a reality. Robotic surgery prevents large incisions and hemorrhages, and, with the challenges that global health systems have been facing, it can serve as a support. Despite these aspects, there are numerous bioethical issues arising from these procedures, which require analysis and discussion. The study, using qualitative methodology, with bibliographic and documentary research, addresses the issue related to the bioethical challenges of the so-called "roboethics". Thus, it investigates the incorporation of new technologies and procedures in health promotion, as well as examines what would be an ethical robotics in health. The bioethical principles related to the use of robotics in surgical procedures are explained, in order to question how the patient's autonomy, non-maleficence, beneficence, justice and equity are perceived in this context. Equally, it is asked whether bioethics could be applied to the robots themselves, and it is pointed out that there is still not an influential regulation on this specific topic. It is concluded that, although the advances are effective and factually present, what must be taken into account is, first of all, the autonomy of the patient's will. Furthermore, it is concluded that the challenges present in these procedures are also related to inequalities with regard to access to health, which demand social interventions aimed at not adopting unequal measures that counter unjust differences.

Keywords: Bioethics. Law. Medical ethics. Robotics. Robotic surgery.

Resumo: Na atualidade, o uso de robôs em procedimentos cirúrgicos e em processos de

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reabilitação é uma realidade. A cirurgia robótica previne grandes incisões e hemorragias, e, com os desafios que os sistemas globais de saúde vêm enfrentando, pode servir de apoio. Apesar desses aspectos, existem inúmeras questões bioéticas decorrentes desses procedimentos, que requerem análise e discussão. O estudo, utilizando metodologia qualitativa, com pesquisa bibliográfica e documental, aborda o tema relacionado aos desafios bioéticos da denominada "roboética". Assim, investiga a incorporação de novas tecnologias e procedimentos na promoção da saúde, bem como examina o que seria uma robótica ética em saúde. Examinam-se os princípios bioéticos relacionados ao uso da robótica em procedimentos cirúrgicos, a fim de questionar como a autonomia do paciente, a não maleficência, a beneficência, a justiça e a equidade são percebidas nesse contexto. Igualmente, questiona se a Bioética poderia ser aplicada aos próprios robôs, e ressalta-se que ainda não há uma regulamentação influente sobre este tema específico. Conclui-se que, embora os avanços sejam eficazes e factualmente presentes, o que deve ser levado em conta é, em primeiro lugar, a autonomia da vontade do paciente. Além disso, conclui-se que os desafios presentes nesses procedimentos também estão relacionados às desigualdades no que diz respeito ao acesso à saúde, que exigem intervenções sociais destinadas a não adotar medidas desiguais e que combatam diferenças injustas.

Palavras-chave: Bioética. Direito. Ética Médica. Robótica. Cirurgia Robótica.

1. Introduction

Humanity has always been fascinated by the possibility that objects and devices have autonomy. The idea of the artificiality of life is present, for example, in the Greek legend of Cadmus, which caused the teeth of a dragon to become soldiers. The human imagination has long been fascinated by this issue, and contemporaneity is the period capable of demonstrating that the existence of robots is possible in a factual reality.

Currently, the use of robots in surgical procedures and rehabilitation processes is frequent. In this sense, with the technological advances related to Artificial Intelligence, Law plays a fundamental role in the analysis of bioethical principles and in the concept of responsibility involved in issues related to robotics.

In this view, it is recognized that the legal dilemmas linked to bioethics have a strong impact on society. They evoke extremely recent problems and deserve more detailed analysis, so that some turning points can be analyzed and clarified. In this regard, considering the surgical processes that use robotics to maximize results, more attention should be paid to the debates that emerge from this discussion.

2. Incorporation of new technologies and procedures in health promotion

The laparoscopic surgeries, recognized as less invasive, have progressed in the medical

field since the 1980s. Thereupon, Robotic Surgery Systems (RSS) were developed, since the United States Armed Forces contemplated the possibility of surgical treatments in war environments, far from where the surgeon was.

In general, RSSs comprise three parts: a surgical cart, a vision cart, and the surgeon's console. The surgeon sits at a control console, which is equipped with a screen that transmits the images obtained by a camera inserted into the patient's body. The surgical console facilitates manipulation by the surgeon of the surgical instruments and the endoscopic manipulator used to perform the procedure[4].

The use of this type of surgery avoids large incisions and hemorrhages, and also promotes faster diagnoses and discoveries of diseases even in the initial phase. Due to this factor, an increasingly rapid use of robotics is perceived in hospitals around the world. However, the current challenge is to extend the method to the public network and to offer remote operations, even from other countries.

3. What would be an ethical robotics in health?

The use of robots in the health area has, in its ethical aspect, a series of questions that can be analyzed according to three different parameters: the impact on society, the alarm regarding the use of robots for the performance of activities previously carried out by humans, and the problems that arise from the use of these technologies by humans[5].

In the first parameter, the social one, the issues related to the substitution of people by robots and the consequences of this in the world of work are pointed out. The question of the quality of care and its dehumanization also arises, since the use of robots would make the presence of "human warmth" unfeasible in the act of caring, which would be negative and would cause the dehumanization of care, since human beings require affective interaction and robots are incapable of feeling and being empathetic.

In the second parameter, regarding the dangers of the actions of robots, questions about the autonomy, the role and the tasks performed by robots are raised; in sequence, the moral inquiry, the questions of responsibility, of deception and of trust. Firstly, regarding the problem related to the concept of autonomy, it is necessary to understand that, at the moment, most

[4] Hashizume, M. & Isugawa, K. (2004). Robotic Surgery and Cancer: The Present State, Problems and Future Vision. *Jpn J Clin Oncol, 34* (5), pp. 227- 237.

[5] Stahl, B. C. & Coeckelberg, M. (2016). Ethics of healthcare robotics: Towards responsible research and innovation. *Robotics And Autonomous Systems.* pp. 152-161.

robots are not autonomous, but are moved by the movements of a surgeon. However, it is worth saying that robots have increasingly gained autonomy, but the full autonomy of robots, in this sense, is recognized as ethically problematic.

At the point of work and tasks, there is the questioning of the performance of robots in the care process, that is, whether they should perform or simply observe the tasks performed by a human being. On the moral issue, it is pointed out that robots are incapable of evaluating moral scenarios, but it is worth noting that perhaps this is not so negative because the lack of ability to think morally makes it necessary to hold humans responsible for the action of the robot.

With respect to responsibility, it is questioned how the distribution of responsibility will be conducted if the robots act autonomously, if it is linked to a human, and how it can respond through the action of a machine over which there was no control. As for disappointment, it is centered on the development and expression of frustrated feelings when directed at a robot and it is wondered if this discontent is justifiable. As for trust, there is the question of whether robots can be trusted to care for children and for elderly, for example.

In relation to the problems that arise from the use of technologies by humans, privacy and data protection are analyzed, that is, who would collect them, who would have access to them, if they would be sold, etc. In addition, safety and ability to prevent damage are also analyzed, as machines must be incapable of causing damage, especially since they are generally used on sick and fragile people.

An ethical robotics in health would be, in this sense, a robotics that could answer these questions in compliance with the principles that permeate bioethics, that is, principles related to autonomy, non-maleficence, beneficence, justice and equity. In this way, there would be the necessary balance for the well-being of the entire surgical environment that uses automata in its procedures.

4. Bioethical principles linked to the use of robotics in surgical procedures

The favorable results obtained with the use of robots in surgical operations resulted in the need to ethically discuss the procedure regarding the possible limits for the use of automata in the operating environment. The question of responsibility in the indication and execution of surgery, in essence, does not differ from medical situations in which there is no participation of robots.

The professional is, in effect, responsible for the participation of robotics in surgical procedures, since the current Brazilian Code of Medical Ethics forbids the doctor to not assume responsibility for the medical procedure that they have indicated or in which they have participated, even when several doctors have done so (article 3), and it also prohibits from attributing their failures to third parties and occasional circumstances, except in cases where this can be duly proven (article 6).

The presence of different bioethical currents, which interweave principles, is added to the indicated articles of the Brazilian Code of Medical Ethics. In this perspective, there are: the obligation of non-prejudice, which covers the principle of non-maleficence, following the principialist current; the need to act for the benefit of the patient, which follows the principle of beneficence, also minding the principialist current; the consideration of self-determination, related to the principle of respect for autonomy, following the principialist current; the act of calculating consequences, derived from consequentialism, based on a utilitarian current; and the act of maintaining moral patient care, related to an ethic of care[6].

It is important to emphasize that both the law and the bioethics establish rules of conduct to follow. However, there are significant differences between the two concepts. Laws generally vary in different localities and are applicable only in the jurisdictions in which they prevail. Ethics embodies the general values and beliefs of the correct conduct. While good ethics generally makes good law, good law does not always or necessarily make good ethics. Most laws, although based on social principles, are derived from other laws. Ethical principles, however, are derived from the values of the society in which they are proposed.

5. Aspects related to patient autonomy in surgical procedures using robotics

When considering the use of robots in surgical procedures, the bioethical principle which firstly stands out is that of patient autonomy, since it is questioned, in this sense, whether the individual could oppose being operated with the assistance of a robot or by a robot, for example.

The autonomy of the patient's will has always been understood as an inherent value of the individual's expression regarding the disposition of their own body and life. Only in the 20th century, with the Nuremberg Code, the requirement for the voluntary consent of people

[6] Siqueira-Batista, R. et al. (2016). Robotic surgery: bioethical aspects. ABCD. *Arquivos Brasileiros de Cirurgia Digestiva*. São Paulo. v. 29, n. 4, pp. 287-290.

who needed to undergo an experiment was normalized, and, in 1964, the World Medical Association, with the Declaration of Helsinki, provided a set of guidelines for the development of clinical studies, which reiterated the need to observe ethical principles in research practice.

Kant adds that autonomy is the basis of human dignity, of any rational creature, thus, he recalls that the idea of freedom is connected with the sense of autonomy, through a universal principle of morality, which is the basis of all the actions of rational beings[7]. In this way, having the autonomy of one's own will is a prerequisite for dignity to be realized.

It is well known that the concept of autonomy and individual freedom, that is, informed consent, is carried out as clear and free consent and, in this way, encompasses respect for the autonomous and independent decisions of individuals, as well as the entire process, which includes establishing a bond in the doctor-patient relationship. Furthermore, the usual restriction on the use of the term written informed consent for higher risk procedures does not mean that other more common procedures can occur without the presence of informed consent, namely, that it can be present without a written expression. In this way, another sense of informed consent is found, which is based on an ideal of equality in the doctor-patient relationship[8].

Personal autonomy is the self-regulation which is free from interference by others and from limitations that prevent meaningful choice, such as inadequate understanding. The autonomous individual acts freely according to a self-elected plan, analogous to how an independent government manages its territories and sets its policies. A person with diminished autonomy, on the contrary, is controlled in some way by others or is incapable of deliberating or acting on the basis of their wishes and plans[9].

Therefore, it is understood as extremely important that, in the procedures, the patient is duly informed of how the surgery will be performed, so that they can oppose it, if necessary, respecting the principle of autonomy of the will.

6. Non-maleficence and beneficence: applications in robotic surgery and rehabilitation with the use of robots

[7] Vide Kant, I. (1999). *Grundlegung zur Metaphysik der Sitten.* Hamburg: Meiner, pp. 68-69.

[8] Pythan, L. H. (2011). O Consentimento informado como exigência ética e jurídica. In: Clotet, J.; Feijó, A.. *Bioética: uma visão panorâmica.* Porto Alegre: Edipucrs, pp. 135-152.

[9] Vide Beauchamp, T. L.; Childress, J. F. (1994). *Principles of biomedical ethics.* 4 ed. New York: Oxford University Press, p. 120 ff.

The principles of non-maleficence and beneficence are related to each other, but differ mainly in relation to the obligations that derive from their applications. Although non-maleficence is summarized as the act of not causing harm, beneficence seeks to promote efforts to guarantee the well-being of the patient. In this sense, beneficence encompasses acts of benevolence or charity which go beyond the strict obligation.

However, the principle of non-maleficence often conflicts with the principle of beneficence, since the doctor must promote the well-being of the patient, which includes the doctor's obligation to preventively treat or prevent diseases, alleviate discomfort and promote welfare. Although the principle of non-maleficence requires abstaining from harmful interventions, the principle of beneficence requires the doctor to act actively. Traditional medical ethics also articulated the principle of care: *Salus aegroti suprema lex*. The patient's well-being is in this maxim, being, in this sense, the priority of medical action[10].

When a surgical procedure uses robotics to improve its results, this action must be carried out combining the two principles[11], which can guarantee a satisfactory result for the patient. In this way, non-maleficence should be considered as a first step to promote the full application of beneficence.

In a procedure using automata, non-maleficence and beneficence must be observed during surgery, and also in the rehabilitation processes if necessary. Rehabilitation robots are divided into therapeutic robots and assistance robots. While therapeutic robots provide task-specific training, the objective of assistive robots is compensation[12]. The use of robotics occurs mainly in the rehabilitation of the marrow of spinal cord injured and of post-stroke, in addition to other deformities, such as traumatic brain injury, multiple sclerosis and cerebral palsy[13].

Therefore, primarily, it is a doctor’s duty to promote the surgery and a surgical environment that do not cause any harm to the patient, and, in addition, that are capable of promoting their well-being. Therefore, it is necessary that the patient is respected, as well as their will, in order not to start the procedure causing them harm. On the other hand, the search for a pleasant surgical environment is also a patient's function. The patient should listen to the

[10] Marckmann G. (2000). Was ist eigentlich prinzipienorientierte Medizinethik? *Ärzteblatt Baden-Württemberg*, v. 56, n.12, pp. 499-502.
[11] Hence the adoption of the same theme to discuss the two principles, although theorists like Beauchamp and Childress have been known to make a distinction between non-maleficence and beneficence.
[12] Chang, W. H. & Kim, Y. (2013). Robot-assisted Therapy in Stroke Rehabilitation. *Journal Of Stroke.* Seoul, pp. 174-181.
[13] Ruiz, P. L. M. (2017). Uso da robótica na reabilitação: aplicação para a fisioterapia. *Revista UNILUS Ensino e Pesquisa.* Santos, v. 14, n. 37, oct./dec. 2017.

doctor and assist them in creating an environment that values everyone's well-being. The doctor should, whenever possible, inform the patient of how the surgery will be performed, at the beginning, if robots will be used in the procedure and some other aspects related to their physical and moral integrity.

7. Justice and equity as "roboethics" principles

The principle of justice in relation to bioethics complements that of equity, since it is an ethical obligation to treat each individual in accordance with what is morally correct and appropriate, to give each their due. The doctor must act impartially and the resources must be distributed uniformly, with the aim of reaching, with greater efficiency, the largest number of people assisted.

Justice as equity is part of the idea of a society as an equitable system of cooperation between free and equal people and is one of the basic intuitive ideas considered implicit in the public culture of a democratic society[14]. In fact, equity deals with equality insofar as it treats equally the ones who are equal, but, when necessary, it treats unequally, but appropriately, the ones who are unequal, when possible and indicated, in order to achieve equality. The fact that there is no adequacy regarding the transformation of health systems into concrete services creates the challenge of equity and justice in high-tech medicine[15].

Equity in health has a moral and ethical dimension and refers to differences that are not only unnecessary and avoidable, but also unfair[16]. It is worth emphasizing that the definition of injustice requires a consideration of the context and that health inequalities are significant differences in health conditions between the different groups defined according to education, ethnic origin, gender, etc. In this regard, the question is whether the use of robots in surgical procedures will be widely used or if there will be a restriction on their use in private hospitals. However, in other words, equity is not the same as equality, especially in the area of health, and not all inequalities are iniquities.

However, it is worth noting that the best strategy to reduce health inequalities is achieved when the exposure to the disease is the same from a social point of view, and not only

[14] Rawls, J. (1985). Justice as fairness: political not metaphysical. *Philosophy and Public Affairs*, v. 14, n. 3.
[15] Vide Drane, J. F. (2009). Equality and Justice in Medicine: a paradigm of Uncertainty. *Bioethikos*. São Paulo, v. 3, n. 1. pp. 33-40.
[16] Whitehead, M. (1991). *Los conceptos y principios de la equidad en la salud.* Organización Panamericana de la Salud 1991. Washington D.C.: Centro de Documentación e Información. Programa de Desarrollo de Políticas de Salud. Serie Reprints; 9.

when access to treatment is the same. The reason is that, although access to the health system is fair, the social determinants of health show that individuals can become ill for socially unfair reasons. If the social determinants of health are not distributed equally among the population, the power of equity in access to health care is not limited to increasing the previous injustice even further, but it cannot eliminate or reduce the injustice[17].

Compared to traditional surgery, robotic surgery is generally more expensive, as a single robot costs around $ 2 million and the system has an annual service contract that requires between $ 100,000 and $ 170,000, beyond the purchase price. These rates justify the higher price of robotic surgery compared to laparoscopic or open surgery[18].

Fortunately, little by little, robots reach the public health network, allowing this advance to be democratized. It is known that in 2018, the equipment was already available on the public network in the states of São Paulo (São Paulo State Cancer Institute and Hospital de Amor) and in Rio Grande do Sul (Hospital de Clínicas de Porto Alegre)[19].

In this way, justice and equity as "roboethics" principles deal with the equivalence of social determinants to achieve an equal reach to the best mechanisms with respect to surgical procedures and also with regard to rehabilitation. In this sense, there would be a democratic delivery of these advances to the entire population, without distinction.

8. As for robots, would bioethics apply to them?

A possible question to be brought up is whether robots would enter as merely auxiliaries of the doctors, unable to think, or whether they would have some "autonomy" in relation to legal issues. The definition of robot that was understood in the European Parliament resolution of 16 February 2017[20] appears associated to the idea of machines capable of acting according to their own experiences. This idea of autonomy, able to ensure that there is an action often

[17] Puyol, A. (2012). Ética, equidad y determinantes sociales de la salud. *Gac Sanit*, v. 26, n. 2. pp 178-181.
[18] Marina del Rey Hospital. What is the cost of robotic surgery as compared to other traditional surgery? Retrieved from <https://www.marinahospital.com/faq/cost-of-robotic-surgery-as-compared-to-other-traditional-surgery>.
[19] Estadão (2018). Robô eleva adesão a cirurgia para tratar o câncer de próstata. Retrieved from <https://saude.estadao.com.br/noticias/geral,robo-eleva-adesao-a-cirurgia-para-tratar-o-cancer-de-prostata,70002611892>.
[20] "Whereas, thanks to the impressive technological advances of the last decade, not only are today's robots able to perform activities which used to be typically and exclusively human, but the development of certain autonomous and cognitive features — e.g. the ability to learn from experience and take quasi-independent decisions — has made them more and more similar to agents that interact with their environment and are able to alter it significantly; whereas, in such a context, the legal responsibility arising through a robot's harmful action becomes a crucial issue;"

unpredictable to the manufacturer, makes them a potential source of damage and, consequently, recipients of possible claims for compensation.

If the assumption that conscious intelligence resides in the human brain is true, laws of robots are just a problem of technological development and computational power. If the assumption that conscious intelligence does not reside in the brain is believed to be true, even super-intelligent robots will never be recognized as people in an ontological sense and can only be conferred on a possible noncritical subjectivity[21].

If they are free, robots must also be considered subjects of law with the rights and obligations that can be attributed to them. However, in each case, a question about the type of legal category to be used arises. From this point of view, it is seen that these capabilities of robots make them less and less attributable to the category of mere tools, machines or objects, and are further removed from the possibility of applying liability or product liability for harmful actions.

The complexity of applying these two types of responsibility lies in the impossibility of assigning to a specific topic – be it the manufacturer, the operator, the owner or the user –the responsibility for the actions carried out with total autonomy by the robot itself. In contrast, the ability to learn from experience and make independent decisions associates robots with the notion of agent, further reducing the boundary between things and people.

In this regard, it is valid to recognize that these issues must be considered and debated, since there are no truly specific regulations on the subject. In early 2019, the Vatican organized a conference to discuss issues related to artificial intelligence as a whole, announcing a concern about new technologies.

In the same event, two opposite positions drew attention. Hiroshi Ishiguro from the University of Ozaka has hypothesized that in 10,000 years humans will no longer be recognized as flesh and blood, as the ultimate aim of human evolution is to achieve immortality by replacing organic tissues with inorganic materials such as plastic and metal. Furthermore, he stated that just as animals have some kind of right today, Ishiguro believes that robots will be given some kind of right.

Otherwise, Christiane Woopen, a professor of ethics and medicine at the University of Cologne in Germany, disagreed with Ishiguro's view on the possible rights of robots. She said

[21] Elmi, G. T.; Romano, F. (2010). Robotica: tra etica e diritto. Un seminario promosso dal Dipartimento Identità Culturale. *Informatica e Diritto*, Firenze, v.19 , n. 1-2, pp.145-152.

rights belong to people and refer to such fundamental questions as human dignity and autonomy[22].

9. Conclusion

Robotics is increasingly present in the contemporary world. It is responsible for guaranteeing assistance in different areas of knowledge, such as health. There are advances in the use of technological devices in surgical procedures and in rehabilitation processes, with good results in the various interventions.

In this scenario, the bioethical debate, as demonstrated throughout the study, becomes urgent. Numerous questions arise, ranging from the most effective sanctions for dealing with errors to what are the most appropriate forms of control to determine the responsibilities associated with the actions of automata. Furthermore, it also questions what legal and technical solutions should be adopted to deal with the fact that robots can be controlled remotely, for example, via the Internet.

It is important to consider that the answers to the above questions will come in time. The study sought to discuss what is already known on the subject of robotics in surgical and rehabilitation settings, in order to bring the importance of debate and analysis to bioethical principles. It is imperative to emphasize that, although these advances are effective, what must be first and foremost considered is the patient's will.

Regarding the inequalities present in health, it is worth emphasizing that social intervention in this matter should not be used to use unequal measures that counterbalance unfair differences. Inequality in health is a complex problem, although urgent and decisive for the future. Therefore, it requires the representation of citizens and management bodies to have an assessment of interests and the provision of services in the area of health.

Medicine advances in such a way that, in the current stage, with the presence of high assistance costs associated with the budgetary restriction of individuals, it generates an imperative of ethical evaluation of the incorporation of new procedures that support the subject in the search for the protection or recovery of human health. However, it is understood that the benefits of robotic surgery justify its current use, although the RSS are not accessible to the entire population.

[22] Instituto Humanitas Unisinos. (2019). Por que o papa Francisco está preocupado com o futuro dos robôs. Retrieved from <http://www.ihu.unisinos.br/78-noticias/587992-por-que-o-papa-francisco-esta-preocupado-com-o-futuro-dos-robos>.

The article underlined the urgency of studies and researches related to robotics, and what derives from it. With the use and improvement of health technologies, it will become increasingly easy to ensure efficient and effective medical treatments, but it is always necessary to be aware if bioethical principles are being applied. These principles, together with a philosophical reflection, can contribute to an agreement between possible different considerations in relation to the medical practices of health promotion, as well as to a harmonious social coexistence between the doctor and the patient during the whole process that adjoins them.

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