

## Robotic surgery – a taste of Hollywood?

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Robotic surgery is a new and promising technique. Numerous authors believe it to be as revolutionary as laparoscopy or thoracoscopy [1]. Let us try to analyze if this is really the case. Multiple instruments, very useful in some cases, have been introduced. They are still being developed and are sometimes far from perfection. Very many centers worldwide perform robotic procedures and publish their results. The cost of the procedure versus the benefit for the patient is the most often mentioned issue. Radical prostatectomy and some cardiac surgical procedures appear to be the most frequent indications. Robotic-assisted surgery is a new method requiring conscientious analysis of the previous results. The method is still being developed and it is difficult to state which indications are beneficial for patients. Surgeons must try to avoid marketing operations behind some of the indications of companies producing robotic instrumentation. Otherwise, the first robotic surgery centers will be seen as “a real taste of Hollywood”.

For the first time the word “robot” appeared in 1921 in one of the theatre plays by the famous Czech writer Karel Čapek and was derived from the Czech word *robota*, literally meaning “work”. The author created a world of intelligent robots, which were supposed to help people at work, make it simpler and perform some of the chores faster. Additionally, these creatures were to be intelligent and form their own society. In Karel Čapek’s play at first they helped people, then they became more and more intelligent. Finally they evolved into highly intelligent creatures

and decided they did not need humans at all. Of course, the play is almost 100 years old, but it is worth giving it a thought and although robots nowadays are not an intelligent and self-aware species, they help us a great deal. They precisely perform special operations in the production process and dangerous industrial procedures, participate in the production of micro and nano processors used for example for computer parts, they are used for exploration of the Universe or sea bottom, and last but not least they are also employed in medicine. The first surgical procedures (mainly cholecystectomies), remote surgical procedures (Lindbergh trans-Atlantic procedure – a surgeon from New York performed his surgery on a patient in Strasburg) would not have been possible without their help [2]. Generally, the use of robots in medicine has been accepted and robotic surgery has come into existence. It has mostly used the developments of revolutionary laparoscopy and thoracoscopy – “keyhole surgery”, not classic, open procedures. Mini-invasive surgery (laparoscopy, thoracoscopy and other endoscopic procedures) is the basis for employment of robots. Generally, the positive aspects of such procedures are widely recognized: reduced pain, small scars, lower blood loss, faster recovery, shorter hospital stay, quicker return to family environment and work, and better cosmetic result. Also, the minimal immunological response of the body is not without importance. Of course, all these achievements of mini-invasive surgery have their limitations. The drawbacks of surgical equipment, which is not always ideal and is constantly developing, are crucial. On the other hand,

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companies produce better and better surgical instruments. Such advances cannot be stopped and it would be senseless to do so. For a surgeon these procedures mean different surgical techniques, coordination of the operator's sight and hand. The surgeon looks at the HD and 3D monitor and his hands work somewhere else. Tactile feedback is missing. During these procedures hand tremor is partially eliminated, tools are rigid, but over 30 cm long, which restricts some of the procedures. It is impossible to perform some of the procedures using this technique (some anastomoses for example). Striving for better, more sophisticated instruments surely activates the development of new surgical techniques. New possibilities have appeared in mini-invasive surgery – the use of robots, and new tool tips, which are capable of working in small areas such as the minor pelvis and heart area. The history of robotic surgery dates back to the 1980s. The National Air and Space Administration (NASA) ran intensive studies to perform remote procedures in space. Numerous scientists, doctors, surgeons, technicians and engineers were involved. Simultaneously, the US Army developed a project which was meant to create a front line system of diagnostics and procedures. Soldiers were transported to a vehicle equipped with a surgical robot. A military surgeon located hundreds of kilometers away was supposed to be able to perform some procedures with a Mobile Advanced Surgical Hospital (MASH). The goal was to help soldiers and reduce the number of deaths. New devices – robots such as AESOP (a robotic machine reacting to the surgeon's voice), ZEUS and Da Vinci – have been used on a regular basis since the 1990s (Photo 1).

Da Vinci appears to be the most perfect and is used in the majority of surgical centers all over the world.



**Photo 1.** Da Vinci

The Da Vinci system consists of 3 components: a 3D vision cart, a control console for a surgeon, and 3 or 4 mechanical arms. One of the arms houses the 3D optic system, while the others are equipped with tools. The surgeon is also required to work with a foot pedal to control focus, electrocoagulation instruments, and a harmonic knife. It must be emphasized here that tool tips can be rotated for 360°, which is one of the most significant advantages of the system. On the other hand, they are still being developed and often leave much to be desired. The possibility to manipulate robotic tool tips (full 7-grade scale) appears to be the most beneficial and is applicable to small operating fields such as the minor pelvis, heart area or retroperitoneal region.

Dr. J. Marescaux and Dr. Michel Gagner from Mount Sinai Hospital in New York performed cholecystectomy on a patient in Strasburg – a few thousand miles distant (September 7, 2001 – “Lindbergh operation”). It took its name from the pilot who flew successfully over the Atlantic for the 1<sup>st</sup> time [2].

Advantages of robotic surgery surely include benefits of mini-invasive procedures (laparo- and thoracoscopy): small incisions, less painful sensation, better recovery and fewer complications connected with it, reduced blood loss, and higher precision of the surgeon. It is also economically beneficial due to shorter hospital stay, reduced consumption of analgesics, and decreased number of transfusions. On the other hand, the high cost of a robotic procedure appears to be the biggest current problem worldwide. Although richer countries may be able to afford wider application of such techniques (the USA), scrupulous economic analysis is also performed there: costs versus benefits for the patient versus the health care system in the particular country. It is known that the health care system can be compared to a black hole, which can absorb any amount of money. Politicians responsible for the budget and health care private investors should decide together if such costs balance the relevant profit for the health care system. What is more, the equipment is also very costly and the number of its uses is limited to 10 times. If the cost of an open operation is assumed as 1 (based on our own experience from the Czech Republic) then the cost of laparo- and thoracoscopy equals 10 and in the case of robotic surgery it amounts to 100. So is it sufficiently beneficial for patients to justify spending so much money? Surely not! On the other hand, progress cannot be hampered and new, better, surgical methods

and techniques must be searched for. Here, I need to express my opinion about that issue on the basis of experience since 1999 – first from Strasburg and then my own from the Czech Republic. My conclusion is as follows: every country will certainly try to keep up with the leading players, but expensive systems cannot be used just anywhere! There are 13 robotic systems in the Czech Republic, which unfortunately were purchased for different centers chaotically and uneconomically, without having given a careful thought to the decision. I believe that a country with such an economy and health care system requires only two centers of robotic surgery supported financially by the Sickness Fund. They would be scientific and research centers, closely cooperating with foreign departments. Likewise in Poland! I think Poland should not make the same mistake and allow chaotic purchase of Da Vinci systems! So that the center which acquires the money to buy the system is not just a center which is only chasing “the surgical taste of Hollywood”. Based on my own experience, I suggest building in Poland a maximum of 5 centers of robotic surgery – well equipped, financed by other sources than the National Health Fund! The anesthesiologist keeps a patient under general anesthesia twice as long as in the case of laparoscopy. The duration of the procedures will surely become shorter, surgeons will learn new techniques faster, but for the time being the situation is as it is. In order not to be overly critical of robotic surgery, positive experiences from two branches – urology [3, 4] and cardiovascular surgery – should be emphasized. It is always about procedures confined to a small space, where surgical robotic tools (360-degree rotation and precision) work perfectly.

Last year’s articles are dedicated to general surgery, urology, vascular surgery, pediatric surgery, gynecological surgery, and cardiothoracic surgery. None of these articles proves explicit advantages over laparoscopic surgery. They are just examples of a surgeon’s “ego” dominating rationality, examples of the “surgical taste of Hollywood”.

Discussions are being held to analyze indications for robotic surgery with stereotactic navigation in cardiology, heart electrophysiology, neurosurgery, orthopedics, liver surgery and other branches of medicine – the news they bring is promising, but does not apply to this article [5].

Let me give my personal experiences and short conclusion. Between October 2008 and February 2012

in the Oncology Center in Nový Jičín, the Czech Republic, 237 robotic procedures were performed – 14 cases of general surgery (10 cases of low anterior resection, esophageal extirpation, inguinal hernia repair, cholecystectomy, Heller myotomy), 166 gynecological operations (mostly hysterectomies and lymphadenectomies), 55 radical prostatectomies and 2 ORL-tonsillectomies. The large number of gynecological robotic operations is caused by the paradox of the health care system in the Czech Republic – a Ministry of Health official made a decision and let the Sickness Fund pay for the very high number of procedures. Radical prostatectomy is the only logical indication. Other procedures belong to the Hollywood group – they are lengthy, experimental and generate enormous costs. 13 sets of robotic systems in the Czech Republic show botched actions of the Ministry and Sickness Funds. After analyzing the Czech economy and needs of the Health Care System they were supposed to decide about the number of robotic surgical centers (2-3 maximum) and their funding outside the Sickness Fund. In contrast to surgical robotics, laparoscopic procedures, which started in the early 1990s in the Czech Republic, flourished luxuriantly during the last two decades and continue to do so [6].

The aim of this Letter to the Editor is not to criticize new methods and robotic surgical techniques. Progress cannot be stopped and it would be illogical to ban it. However, one has to consider the benefits of such advances for the patient. For the time being, prostatectomies [3, 4] and some cardiovascular procedures appear rational. Robotic surgical procedures’ economic aspect should be analyzed and we have to reconsider whether our countries (Poland, the Czech Republic, Slovakia) are at such an economic level that they are able to compete with more economically developed countries such as Germany. I believe that they are not [1]. Certainly, only a few robotic surgical centers need to be built in each of our countries. They should carry out scientific research, should be supported by other than state funds, and should cooperate with each other so that the whole system does not become just “a taste of Hollywood” for a particular surgeon or center.

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