

COMMENTARY



A Brief History of Telesurgery

Dear Editor,

Telemedicine (the provision of health care utilizing remote means) includes a wide range of medical practice and education, also encompassing the field of surgery (Jagrapu and Savani, 2021, pp. 1-3). Telesurgery employs modern medical and telecommunication technologies to facilitate the virtual presence of a surgeon in the operating room. Telesurgery is widely recognized as a valuable element in the field of telemedicine, attracting considerable attention.

In this article, we aim to discuss the history of telesurgery worldwide and the advancements made in robotic systems integration, considering the limited availability of comprehensive scientific literature in this domain.

Telesurgery has experienced substantial progress since the 1920s, with notable advancements in the 1970s and 2001. It has now evolved into a worldwide industry, involving diverse systems and impacting millions of patients. The origins of telesurgery in Europe can be traced back to the early 20th century. However, notable progress

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was made in the 1990s and 2000s, culminating in the first successful telesurgical laparoscopic cholecystectomy performed on March 3, 1997, at St. Blasius Hospital in Dendermonde, Belgium. The Lindbergh operation, the first transatlantic human telesurgery, was developed between 1994 and 2003 by the Institute for Research into Cancer of the Digestive System (IRCAD) in partnership with Computer Motion Inc. The procedure was conducted in September 2001, with a surgeon based in New York, USA, and a patient located in Strasbourg, France (Xia, and Lu, 2021, pp. 144-147). The United States Army Special Operations Forces in Somalia employed augmented reality in 2017 to stabilize critical injuries, thereby introducing telesurgery for the first time in Africa (Mehta, et al, 2022, pp. 1-2). In 2018, Indonesia, an archipelago country with more than 17.000 islands, initiated its first training centers for two Iran-made robotic telesurgery named “Sina” as a form of collaboration for both countries in the field of medical equipment that is expected to improve health services access and quality for unreachable regions in Indonesia (Rudiman, Mirbagheri, and Candrawinata, 2023, pp. 2757–2761).

The field of telesurgery has witnessed remarkable advancements since its inception in the 1920s, with notable progress made in the 1970s and 2001. These developments have enabled telesurgery to evolve into a global industry, encompassing a wide range of systems and significantly impacting the lives of millions of patients worldwide.

The advancements in robotics, telecommunications, and computer technology that resulted from laparoscopic surgery and space research have made telesurgery systems possible. The PUMA robotic telesurgery system, introduced in 1985, marked the debut of the first “robot surgeon” employed on a human patient (Morrell, et al, 2021; Pandav, et al, 2022). The implementation of Probot technology commenced in 1985, initially being employed in neurosurgical biopsies. The Thomas J. Watson Research Center developed the Robodoc surgical assistant system in 1986. It was first employed on human patients in 1992, specifically for orthopedic surgery. The design of Da Vinci’s creation, which first appeared in 1495, resembled a Germanic knight and also drew inspiration from the adaptable traits of animals like octopuses. Additionally, it drew inspiration from the concepts put forth by notable historical figures such as Aristotle, Leonardo Da Vinci, and Karel Capek. The inception of the initial prototype of this technology occurred at Stanford University in 1987, under the supervision of Drs. Phil Green and John Bowersox. Computer Motion Inc., located in Goleta, California, successfully developed and launched the Zeus robotic telesurgery system in 1998, thanks to substantial grants and Food and Drug Administration (FDA) clearance obtained since 1994. The Robodoc Surgical System, an image-guided system, was developed in 1992 specifically for prosthetic hip replacement procedures (Morrell, et al, 2021, pp. 2-7; Xia, and Lu, 2021, pp. 144-147).

Robot-assisted remote telesurgery can now be safely carried out across transoceanic distances, eliminating geographical constraints and improving patient treatment and surgical training. The da Vinci surgical system is the leading teleoperated robot in the global market. Over 4000 da Vinci robotic platforms are presently in use throughout the world, and over 200,000 robotic procedures are carried out annually (Marino, et al, 2018, pp. 291-296). Telesurgery robots are now specialized and can be further categorized according to their specific application fields.

At present, telesurgery encounters various obstacles. These include the high cost of



telesurgery robots available on the market, the crucial role of stability and safety in ensuring successful remote surgery, and the absence of legal and ethical guidelines to determine the responsible party when a breach of care occurs. Lack of communication bandwidth has slowed down progress in robotic telesurgery (Xia, and Lu, 2021, pp. 144–147). The emergence of artificial intelligence and 5G network technology will facilitate the progress of telesurgery in the future. Future research efforts will aim to enhance the effectiveness of current robotic systems and improve on existing models. Moreover, as humanitarian resources are partitioned to developing countries, an expansion of telesurgery in lower-income countries may occur, reducing logistical and travel burdens for surgeons from the developed world.

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Authors' Contribution

Laila Rahmah and Ardalan Shariat conceived the idea, design, and wrote the original draft for the work. Sukadiono Sukadiono, Gholamreza Hassanzadeh, and Albert T. Anastasio reviewed and interpreted the work. All authors read and approved the final version of the work

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Conflict of Interest

None.

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