

Chapter 14

Applications of Robotics in Gynecological Surgery

Ciro Comparetto

 <https://orcid.org/0000-0002-2985-4478>

Department of Obstetrics and Gynecology, San Paolo Private Clinic, Italy

Franco Borruto

 <https://orcid.org/0000-0003-0667-8851>

Independent Researcher, Monaco

ABSTRACT

Robotic-assisted surgery is a branch of engineering that develops robotic machines that allow the operator to perform surgery by maneuvering, from a distance, a robot that is not completely autonomous but capable of performing controlled maneuvers. It is a technique that has recently come into use, even in selected centers, and represents a further step in the field of minimally invasive surgery (MIS). It has basically the same indications, but, at the moment, it is reserved for selected patients. Compared to traditional video-assisted surgery, it has some important differences. The surgeon is physically distant from the operating field and sits at a console, equipped with a monitor, from which, through a complex system, he controls the movement of the robotic arms. To these are fixed the various surgical tools—forceps, scissors, dissectors—which a team present at the operating table introduces into the cavity where the surgery is performed.

INTRODUCTION

In the field of medicine, the branch that has made the most progress in the last 20 years is surgery. In truth, surgical techniques have undergone a complete revolution as a result of scientific study and the introduction of new technology in the field. Today, endoscopic approaches, such as laparoscopy, robotic surgery, and hysteroscopy, are the gold standard for treating numerous illnesses. Robotic surgery, also known as computer-assisted telemanipulation, is a type of operation performed using sophisticated sur-

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gical platforms that are capable of replicating, by way of miniaturization, the movements of the human hand within the human body, or in any event in the surgical field (Palep, 2009).

The most recent advancement in technical advancements used in surgery is currently robotic surgery. Contrary to popular belief, robotic surgery is not a procedure carried out by a machine. It is a minimally invasive laparoscopic procedure that needs to be overseen and carried out by qualified medical professionals. Both traditional laparoscopic surgery and robotic surgery, in which a robot precisely mimics the movements of the surgeon, are safe treatment options; however, only highly specialized surgeons with adequate training, essential skills, and extensive experience in minimally invasive laparoscopic and robotic surgery should perform either procedure. As a result, the robot in the operating room is unable to make decisions or act on its own (Gültekin et al., 2021).

Robotic surgery is used by surgeons to precisely help during surgery. Many people believe that this kind of surgery is less intrusive because the incisions are smaller. Through robotic surgery, the surgeon is able to control the robot's arms, which are attached to high-precision tools. This device improves the precision and safety of surgery because it offers the surgeon the ability to perform movements that the human hand alone would not be able to do. Obviously, a great experience and skill of the physician who uses it is always indispensable at the base of robotic surgery (Ng & Tam, 2014; Guerin et al., 2022).

MINIMALLY INVASIVE SURGERY

A group of procedures known as minimally invasive surgery (MIS) allows for the performance of surgical procedures through incisions that are only a few centimeters (cm) deep, thereby reducing the trauma associated with the treatment. Compared to traditional ("open") surgery, which involves a cut of several cm to expose the part to be treated, minimally invasive technique allows to reach the area on which to intervene with tools such as cameras, lights, and scalpels, which pass through a few cm. The last 40 years have seen the development of minimally invasive procedures. Although the research and study date back to the 19th century, the first surgery was in 1987, when a French physician, Dr. Phillipe Mouret, completed the first cholecystectomy with laparoscopic technique (Al-Akash et al., 2009).

This procedure was developed starting from the knowledge acquired in diagnostics applied above all to gynecology. Diagnostic laparoscopy, already used in the past specially to analyze the abdominal cavity, has evolved to become one of the most used surgical techniques. In fact, laparoscopy, endoscopy, and robotic surgery are included in MIS (Cho et al., 2010).

It is possible to apply this type of surgery, depending on the pathology, to all medical specialties that require the execution of interventions, such as cardiac surgery, urology, gynecology, orthopedics, etc. With MIS, today, a whole series of interventions can be made: in addition to observation and diagnosis, removal of anatomic parts and tumors, restoring heart and lung function, inserting prostheses (knee and hip), making transplants (such as kidney), etc. Among the pathologies that currently see a greater use of the minimally invasive procedure are (Ulmer, 2010):

- gallbladder stones and appendicitis;
- colorectal, stomach, and liver cancer;
- pathologies that involve the removal of the spleen;
- Crohn's disease and ulcerative colitis;
- obesity;

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