



## The future of robotics

It is an extraordinary pleasure to present this series on advances in robotic minimally invasive surgery (MIS). The term “robot” was coined by the Czech playwright Karel Čapek. In his play RUR (Rossum’s Universal Robots) in 1920. The term came from the word *robata* meaning serf or forced labor. Later the term “robotics” was introduced by Isaac Asimov, author of the much beloved *I, Robot* series in a short story entitled “Liar!” which was published in 1941 (1). While there are no truly autonomous sentient robots to date, the famous admonition, “Danger Will Robinson!” (2) will likely come to pass in the near future with the introduction of artificial intelligence into future robotic platforms.

The minimally invasive revolution which exploded onto the surgical horizon in the late 1980’s. This has forever changed the landscape of surgery. Although peritoneoscopy emerged at the dawn of the 20<sup>th</sup> century with candles as light sources and hand drawn illustrations by the physician as the primary mode of image capture as they peered down the telescope. The camera, light source and monitor were the transformational agents moving this from the actions of a single surgeon to a team engagement. The years 1990 to 2000 was the first era of novel MIS instrumentation. An amazing array of new tools, such as advanced energy devices, smaller instruments, dedicated staplers all facilitated the emergence of new minimally invasive procedures in every nook and cranny of the body. Coupled with this has been a massive education effort training a generation of surgeons who trained only in open surgery and converting them to minimally invasive surgeons as well as incorporating MIS techniques in residency training. In the United States (US), the effort was led initially by the Society of Gastrointestinal and Endoscopic Surgeons (SAGES) who set standards for training programs at all levels. It has been truly gratifying to observe the emergence of the global effort with the rise of so many local/regional societies dedicated to the advancement of MIS, innovation and training worldwide.

The new millennium heralded the introduction of surgical robotics with the US Food and Drug Administration approval of the DaVinci robot in 2000. The process began with a lot of fanfare, with the transatlantic “Lindbergh” laparoscopic cholecystectomy procedure (3). The growth was initially slow in cardiac surgery, then general surgery, but took off with the adoption of the surgical robot as an enabling technology in the performance of MIS prostatectomy. Once again, the task of training surgeons has mounted on a global scale. This year, it is likely more than 800,000 “robotic” procedures will be performed worldwide. Arguments of cost versus value will persist for years to come, however there is no doubt surgical robotics or perhaps more precisely computer assisted telemanipulation surgery (CATS?) is here to stay. With that, will come the second era of novel instrumentation, advances in robotic surgery from a wide variety of sources now that the surgical beachhead has been established. It will be exciting to watch these advances manifest. We hope you get a flavor of what is possible in this series.

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