Preface

Technological advancements in thoracic surgery: a brief introduction to the future

Technology and the creative use of the newly developed, charge coupled device cameras, thoracoscopes, clip appliers, and energy devices enabled the laparoscopic and thoracoscopic revolution of the 1990s. Without doubts, evolving technology sustained and will maintain the development of minimally invasive surgery. But the technology that fuelled the video-assisted thoracic surgery (VATS) revolution is aged and now hinders further advances in the field (1).

The word technology was first used in 1829. The etymology is from Greek and means the systematic philosophical treatment of art because these reflections are about as old as technology itself (2). In the ancient Greece, there are four prominent themes about technology. The first thesis is the technology learning or imitation from nature. According to Democritus, house-building and weaving were first invented by imitating swallows and spiders building their nests and nets, respectively. Aristotle referred to this tradition, but he did not maintain that technology can only imitate nature. A second theme is the fundamental ontological distinction between natural things and artefacts. The purpose of nature drives the four elements to move, grow, change, and reproduce themselves by inner final causes. Artefacts cannot reproduce themselves, and without human care and intervention, they vanish by losing their artificial forms and decomposing into natural materials. The alchemic thesis that a fundamental difference between human-made products and natural substances has had a long-lasting influence in the Middle Ages. Aristotle's doctrine of the four causes (material, formal, efficient and final) can be regarded as the third contribution philosophy of technology. The last point is the meaningful employment of technological images by Plato and Aristotle for voicing their trust in the rational design of the universe (3).

Therefore, everything occurs in circular sequences: revolution, change, adaptation to change, acceptance of the new standard, organizing the new establishment, resistance to further change, revolution, and the cycle begins again. In surgery, this cycle had been occurring about every 100 years, but recently there has been a perceptible acceleration of this cycle. The first surgical revolution came during the Industrial Age in the mid-1800's with the simultaneous introduction of anaesthesia, asepsis, pathology, new instrumentation, and so on. Nearly a hundred years later, in the mid-20th Century, surgery was advancing with antibiotics, intravenous fluid, radical surgery resections. By the 1990s, minimally invasive surgery emerged and became the standard for many procedures. Information Age technologies, such as video cameras and monitors, continued the evolution (4).

New technological advancements are used in general thoracic surgery to treat disease processes such as benign and malignant airway, as well as the chest wall, mediastinal, and oesophageal disorders. New technologies could privilege thoracic surgeons in expanding an existing skill set or could achieve thoracic surgeons to perform new procedures outside the traditional boundaries of thoracic surgery (5).

In 1992, a joint committee of The Society of Thoracic Surgeons and The American Association for Thoracic Surgery believed a new designation for thoracoscopy was necessary to portray adequately the broad spectrum of procedures performed by the VATS approach (6). It appears that the evolutionary nature of VATS is due to the technological advancement occurred (7). A 2013 study supports the proposition that technology-driven, minimally-invasive techniques are in a broad sense better for both patients and society. Analysis of data showed that less invasive procedures resulted in lower costs for the healthcare system (8). The demand for minimally invasive surgery is in some cases induced by dealers of surgical technology, leading to an expensive procedure sometimes being chosen, even if of comparatively small marginal benefit to the patient. But to evaluate the actual cost per patient, direct costs of investing in new technology reduce other cost factors such as the patient's hospital length of stay (9).

Nonetheless, technology is accelerating quicker than ever, and we are on the edge of another revolution. This is a time, in the history of thoracic surgery, when the truthfully revolutionary transformation is occurring at a rate never seen before. While it is a historical fact that each generation of physicians significantly exceeds the accomplishments of the previous generation, the magnitude of actual changes is extraordinary. The surgeon of the future will need to absorb a wider range of the new technologies, quicker than ever before. Surgeons will be held to even higher standards than today. Therefore, the extra amount of work required to achieve these new standards is essential to be worthy of the enormous responsibilities that these changes will bring (4).

This special issue of the *Journal of Visualized Surgery (JOVS)* focuses on the technology role in the thoracic surgery. Our aim was to update the readers on the technological advancements from the surgical point of view through papers from leading authors about technology, virtual simulation, 3-dimensional VATS, and more and more.


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