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SPECIAL ISSUE ON ROBOTS AND DEVICES IN SURGERY

Surgical practice has undergone some major changes over the past two decades with the increased adoption of minimally invasive surgical therapies (MIST), whereby surgical interventions are performed through a 'key-hole' or endoscopic approach. Although conventional laparoscopic surgery offers advantages, such as post-operative pain reduction, smaller scars, quicker recovery times, reduced hospital stays, and improved cost-effectiveness, it is disadvantaged by the loss of dexterity for the human hand/fingers and the lack of tactile feedback.

Such limitations have led to surgeons turning to their colleagues in the engineering sciences to find new solutions. Inevitably, this has led to the increasing application of robotic and computer assistance into surgical practice. Currently, the da Vinci_ surgical system (Intuitive Surgical, California, USA) is the only integrated master–slave robotic system that is commercially available for clinical application. However, the last five years have seen a surge in research activity to develop new and increasingly sophisticated tools, devices, and systems for robotic surgery in the hope that these will facilitate and improve the performance of complex minimally invasive procedures for the benefit of both patients and healthcare providers.

This Special Issue is therefore particularly timely and presents a collection of review and original research papers that will provide the reader with the opportunity to become familiar with some of the major activity in this area. Two articles set the scene and help to clarify the current state of the art of MIST, together with its limitations, as applied to the gastrointestinal tract: one article provides a comprehensive review of swallowable devices, whilst the other presents the current experience with the da Vinci system in colorectal surgery. Other contributions then address some of the fundamental limitations of MIST, such as the need for preoperative and intraoperative real-time imaging, the application of force sensing, use of magnetism to aid tissue handling and retraction, wireless power transmission for endoscopic devices, and biomimetic solutions for device adhesion. The remaining articles present devices and systems, in various stages of development, for application in MIST, natural orifice and transendoluminal surgery (NOTES), endovascular therapy, and other challenging environments, such as the spinal canal and inner ear. The collection of manuscripts is completed by a more general article that we believe will be of interest to all researchers and developers of robotic technology, namely the potential use/misuse of metadata in litigation.

It is clear from the papers presented in this Special Issue that for surgical technologies to advance there is a real need for a multidisciplinary approach to device and system design that includes aspects of control engineering, dynamics, kinematics, mechatronics, and basic engineering science. We hope this collection of articles gives a flavour of some of the significant recent advances made by some of the world's leading research groups and also provokes thoughts on where the outstanding challenges lie.

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