

## Automated MIS technology

# Enhancing surgical precision



The quantum leap in technology in the recent past has propelled a drastic change in medical procedures, especially in surgery and allied areas. Keeping pace with this progress, the field of minimally invasive surgery (MIS) has also witnessed a good measure of innovations and developments in the equipment used. **KTP Radhika Jinoy** dissects this transformation in surgical technology.

As in every other field of medicine, technology has brought forth cutting-edge modifications in surgery. Moreover, an apparent change has occurred in this field in the recent past. The pace and ease with which medical professionals perform complex surgical procedures today stand testimony to the progress of surgical technology and rapid evolution of modern devices.

In surgical procedures, especially in minimally invasive surgery (MIS), considerable technological advancements are happening. Modern surgical practices such as laparoscopy, neurosurgery and practically all super-specialty surgeries quite facilitated by technology. Dr Vinod Chandiramani, head of department-General Surgery, PD Hinduja National Hospital & Medical Research Centre, says, "The importance of technological advancements in surgery can be gauged through parameters such as minimal access causing less discomfort, smaller incisions, better cosmesis and early return to work. Any technology that supports these factors in a safe surgical environment will be in great demand." New cutting-edge technology used in MIS has added a new dimension for patients undergoing surgical procedure.

The advancement in surgical procedures offers micro-surgery followed by laparoscopic methodology. Currently, laser and robotic surgeries are increasingly being used. Invasive surgeries have been steadily replaced by non-invasive methods, and further developments such as radio-surgery are taking place in non-invasive surgeries. Indradip Das, senior consultant, Hosmac Consultancy Services, says, "These advancements help the doctors to aim for achieving more accurate result and less operative trauma, thus lowering post-surgical complications. Patients benefit in terms of quick recovery, lesser pain & scare and high success rate. Besides, more bed turnover ratio also benefits the hospital to generate more revenue by treating large number of patients."

### Fibre technique and laser technology

Fibre technique is one of the advanced technologies used in surgical procedures. It is considered a major breakthrough in the field of medical technologies. Dr Pradeep Chowbey, director-Institute of Minimal Access, Metabolic & Bariatric Surgery, Max Healthcare, says, "Fibre-optics provide excellent vision of internal

organs during endoscopy and laparoscopic surgery." Image transmitter device has improved over the years to support today's laparoscopic surgery. Fibre technique provide more control while using lights during the surgery, where a fibrescope is often used to visualise small components. A fibre-optic probe is used in soft-tissue laser surgeries such as angioplasty. The probe comprises a section of an optical fibre containing a beam-inlet end & a beam-outlet end and is composed of a beam-propagating core as well as cladding. A part of this cladding is removed to reveal openings through which a portion of the laser beam leaves the fibre-optic probe. The laser beam is directed laterally to the longitudinal axis of the fibre to the operation site. The intensity distribution of the outgoing beam can be controlled by selecting a required pattern of distribution of the openings. A newly developed flexible, hollow photonic bandgap fibre (PBF) makes endolaryngeal dissection easy to perform. The new techniques make procedures considerably uncomplicated compared to the earlier ones. The fibre-optic illuminator is designed to transmit light efficiently, with little loss and is economically disposable.

Another milestone in medical technology has been the laser technology. This technology has various roles in all forms of surgery, making it precise, quick and less invasive. Light amplification by the stimulated emission of radiation (widely known as Laser), emits light of specific wavelength, which can seal, cut or vapourise the tissue and blood vessels. With the varied range of emitting wavelength, laser has the



“ Robotic radical prostatectomy and robotic hysterectomy are well-established surgical procedures that offer several advantages such as early recovery, minimal blood loss, better continence and preservation of pelvic nerves ”

- Dr Vinod Chandiramani, head of department-General Surgery, PD Hinduja National Hospital & Medical Research Centre



Surgeons performing laparoscopic surgery with the help of cameras

thousands of mile away from the surgeon. A surgery performed in this way is known as 'Trans Atlantic minimal access surgery'. Dr Chowbey informs "This technology has a great future in performing difficult laparoscopic procedures with minimal effort and great efficacy. At present, it is most commonly used in surgery for prostate cancer. With time, more surgeries can be performed using a robot. However, the biggest constraint at present is the cost of the robot and disposables used for the operation." Surgical robotics is an evolving field, with great advances having been made over the recent years. Some of the devices used to perform robot-assisted surgery are discussed below.

**da Vinci system:** Currently, one of the common, commercially available surgical robots is the *da Vinci* robot, which is used for all kinds of advanced cardiac/urological/general surgical procedures. Manufactured by Intuitive Surgical Inc, the *da Vinci* computer-assisted robotic system expands a surgeon's capability to perform laparoscopic surgery in a less invasive way. The *da Vinci* system allows greater precision and better visualisation compared to the standard laparoscopic surgery. Incorporating the latest advancements in robotics and computer technology, this surgical system is the first operative surgical robot deemed safe & effective by the US Food and Drug Administration for performing surgery. In July 2000, the FDA cleared the *da Vinci* system, as an endoscopic instrument control system for use in laparoscopic surgical procedures. This system consists of a surgeon's console, which is typically in the same room as the patient, and a patient-side cart with four interactive robotic arms controlled from the console. "The most recent advance in the robot is the four-arm robotic device and the three-dimensional view," says Dr Chandiramani. Three arms are for tools that hold objects and act as scalpel, scissors, bovie or unipolar/dipolar electrocautery instruments. The fourth arm is for an endoscopic camera with two lenses that gives the surgeon full stereoscopic vision from the console. The *da Vinci* system scales, filters and translates the surgeon's hand movements into more precise micromovements of the instruments, which operate through small incisions in the body. Apart from less pain, less blood loss and less need for blood transfusions, this system also enables shorter hospital stay, quick recovery and fast return to normal routine activities.

**Zeus:** This is the youngest advanced robotic aid. FDA cleared this technology in October 2001. Das avers, "Zeus contains machine arms that mimic conventional surgical equipment and a viewing monitor that gives the surgeon a view of his operative field. More importantly, Zeus enables a surgeon to operate on a patient with the help of joystick-like handles, which translate the surgeon's hand movements into precise micro-movements inside the patient." Peerless voice control capabilities of the device allow the surgeon to precisely guide the movements of the endoscope with simple spoken commands, keeping the surgeon's hands free to manipulate the robotic surgical instrument handles. It can filter out hand tremor, providing surgeons with a greater capability to perform complex micro-surgical tasks.

**Aesop:** *Aesop's* function is simple, which is merely to manoeuvre a tiny video camera inside the patient according to voice controls provided by the surgeon. With this function, *Aesop* has eliminated the need for a member of the surgical team to hold the endoscope for a surgeon to view his operative field in a closed-chest procedure. This advancement has marked a major development in closed-chest or port-access bypass techniques, as surgeons can now directly and precisely control their operative field. Das says, "Today, about one-third of all minimally invasive procedures use *Aesop* to control an endoscope."

**Hermes:** Unlike *Aesop* and *Zeus*, *Hermes* does not use robot arms to make the operating room (OR) more efficient. Rather, it is a platform designed to network the OR, integrating surgical



“Laparoscopic surgery requiring removal of large organs can be done by a hand-assisted technique introduced inside the abdomen through a special hand port. It helps to palpate and feel the organ”

- Dr Pradeep Chowbey, director-Institute of Minimal Access, Metabolic & Bariatric Surgery, Max Healthcare



Surgeons performing Trans Atlantic minimal access surgery