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Editorial

Minimal Access Surgery

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The cleaner and gentler the act of operation, the less the patient suffers, the smoother and quicker his convalescence, the more exquisite his healed wound.

Berkeley George Andrew Moynihan (1920)

Surgery is a rapidly expanding branch and the only truth in surgery is change. New concepts in surgery are not always accepted readily; these usually meet with an initial resistance. The great example of this has been minimal access surgery. Kelling introduce a visuliasing scope in the peritoneal cavity of dog for the first time in 1901. In 1911, Jacobaeus reported first laparoscopy procedure in humans. In 1981, Kurt Semm performed the first Laparoscopic Appendectomy. Laparoscopic Cholecystectomy was first performed by Prof. Erich Muhe on 12th September 1985. The first video laparoscopic cholecystectomy was performed by Mouret from France. In USA, Reddick and Olsen did pioneering work in the field of laparoscopic surgery. Kalloo et al. first describes Natural orifice transluminal endoscopic surgery (NOTES) in an animal model. Reddy and Rao were the first to perform human NOTES when they performed transgastric appendectomy in India.

Table 1: Milestones in the development of minimal access surgery

Physician	Year	Procedure
Kelling	1901	Examination of dog peritoneal cavity
Jacobaeus	1911	First laparoscopy procedure in humans
Kurt Semm	1981	Laparoscopic appendectomy
Erich Muhe	1985	Laparoscopic cholecystectomy
Mouret	1987	Video laparoscopic cholecystectomy
Kwoh et al	1988	Stereotactic brain biopsies
Pelosi et al	1992	Single-puncture laparoscopic appendectomy
Navarra et al	1997	SILS cholecystectomy
Kalloo et al	2000	First animal NOTES
Reddy	2004	First human NOTES appendectomy
Marescaux et al	2007	First human NOTES cholecystectomy

SILS: Single Incision Laparoscopic Surgery; NOTES: Natural Orifice Transluminal Endoscopic Surgery

Minimally access/invasive surgery is a means of performing major surgeries via small incisions as compared to larger incision needed in traditional laparotomy, often using specially designed instruments and miniaturized, high-tech imaging systems, to minimize the trauma of surgical exposure. Minimal access does not refer to magnitude of invasiveness as absolute criteria, but invasiveness or accessibility is compared with the conventional open surgery. When the concept of minimal invasive surgery was introduced, it was expected to better or at least equal the results of more traditional procedures. Thirty years after introduction, laparoscopic surgery has fulfilled most expectations. With the introduction of minimal access surgery, the importance of open surgery is decreasing. Now-a-days, almost all general surgical operations can be performed using minimal access including procedures in the chest and abdomen.

Broadly, Minimal access surgery can be categorized as: *Laparoscopy, Thoracoscopy,*

Endoluminal endoscopy (Upper Gastrointestinal scopy, Colonoscopy, cystoscopy, bronchoscopy, NOTES etc), Perivisceral endoscopy (mediastinoscopy, retroperitoneoscopy etc) and *Arthroscopy.*

NOTES combines techniques from both laparoscopy as well as endoscopy and is performed by making incisions in hollow viscera. There are two categories of NOTES: Hollow-visceral transperitoneal (HVT): Transgastric, transcolonic, and Squamous conduit intraperitoneal (SCI): Transvaginal, Transanal.

NOTES can also be classified as "pure NOTES " where only natural orifice is used, Rendezvous NOTES where more than one portal of entry is used to complete the surgery like transabdominal laparoscopy port, and Robotic NOTES where Da vinci surgical robot is used to perform various procedures. The most successful route is transvaginal as closure is easy and it is expansile.

The basic idea in single incision laparoscopic surgery is to introduce all necessary instruments through a single incision. SILS can be seen as a bridge between multiport laparoscopy and NOTES. Potential advantages of SILS are: better cosmesis, less trauma, and less chances of incisional hernia. Main disadvantages over conventional multiport surgeries are: Loss of triangulation, clashing of instruments and lack of tissue retraction by assistant surgeon. SILS uses umbilicus as a portal of entry. Transumbilical approach may be associated with high incidence of port site hernia and wound infection. Therefore, Remote access laparoscopic surgery (REAL) was developed where the pubic line is used as a distant portal of entry Main difference between NOTES and SILS is NOTES leaves no scar, while SILS leaves one small scar at the umbilicus.

In robotic surgery the surgeon uses a computer console to manipulate the instruments and a computer transmits the surgeon's movements, which are then carried out on patient's body by the robot. Robot can be passive, semi active, or active depending on the functions.

Few examples of commercially available and FDA approved robots are: AESOP system (Computer Motion Inc., Santa Barbara, CA), the comprehensive master-slave surgical robotic systems, Da Vinci (Intuitive Surgical Inc., Mountain View, CA) and Zeus (Computer Motion Inc., Santa Barbara, CA).

Advantages of assistance of robotic system are:

- Improved vision (3 Dimensional vision).
- Increase dexterity.
- Ability to perform complex procedures.
- Decreased learning curve.
- Better hand eye coordination.

Disadvantages of robotic system are:

- Cost.
- Size of the system.
- Lack of compatible instruments and equipments.
- Loss of tactile sensation.

Advantages of minimal access surgery are:

- Post operative pain, and wound complications are reduced.
- Post operative pulmonary complications are reduced.
- Immunosupression caused by surgery is decreased.
- Decreased wound trauma.
- Improved vision.
- Decreased heat loss.
- Improved cosmesis.
- Reduced contact with patients blood.
- Short hospital stay.

Disadvantages of Minimal Access surgery are:

- Expensive technology.
- Technical expertise: reliance on remote vision, loss of tactile feedback, and dependent on hand-eye coordination.
- Potential complications related to trocar insertion.
- Difficulty in achieving hemostasis.
- Retrieval of intact organs is difficult particularly if large or containing malignancy.

The main limitations of traditional open surgery are: wound size, Trauma to tissue by retractors, and exposure of the cavity to the atmosphere. In minimal access surgery, wound related complications like infection, dehiscence, and pain are minimal. In laparoscopic surgery, gentle and even retraction is provided by pneumoperitoneum associated with minimal trauma.

Pre-operative preparation and evaluation is essentially same as conventional surgery. All patients must be counseled about the specific risks involved in minimal access surgery and possible conversion to conventional surgery.

Minimal access surgery has fundamentally changed surgical technology. In many aspects, minimal access surgery yields better results than its conventional open counterpart. With increasing experience, minimal access surgery offers cost-effectiveness to the health services and to patients by short hospital stay and early return to work. There are many things which are new in minimal access surgery but only time will tell how much is really better. In the future, minimal access surgery will probably replace traditional open surgery.

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