

# PD233: Design of Biomedical Devices and Systems

(Lecture-12 Surgical Tools & MIS Devices)

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Course Website:

<http://cpdm.iisc.ac.in/utsaah/courses/>

## Surgical task

- *-centesis* : surgical puncture
- *-clasia* : crushing or breaking up
- *-desis* : fusion of two parts into one, stabilization
- *-ectomy* : surgical removal
- *-opsy* : looking at
- *-oscopy* : viewing of, normally with a scope
- *-ostomy* or *-stomy* : surgically creating a hole
- *-otomy* or *-tomy* : surgical incision
- *-pexy* : to fix or secure
- *-plasty* : to modify or reshape (sometimes entails replacement with a prosthesis)
- *-rrhaphy* : to strengthen, usually with suture

# Surgical tools



- Forceps
- Clamps and occluders
- Retractors
- Distractors, positioners and stereotactic devices

- Mechanical cutters (scalpels, drill bits, trocars etc.)
- Dilators and specula
- Suction tips and tubes

Image credit: kevinmd.com

Surgeons need right tool for action

In addition, these tools need to be:

- Sterilisable
- Ergonomic
- Available in various size to cover for biological variations
- Correct labelling (at least on the packaging)

# Minimally Invasive Surgery (MIS)

Same task need to be performed via small incision. More difficult skill to master but then why do minimally invasive surgery?

Better clinical outcome:

- faster recovery

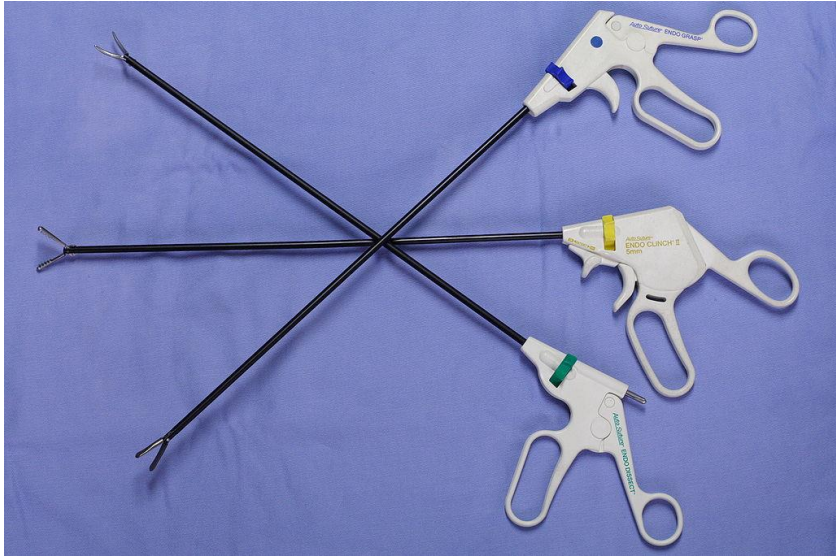
- less chance of infections

- smaller scar

# Additional requirements for MIS

- To see
  - optical access
  - additional light source
- Tools should fit into access ports/ catheters
- Mechanism to provide additional degree of freedom
  - Tool navigation
  - Tool positioning and retraction
  - Tool operations
- Body inflated with pressurised gas (CO<sub>2</sub>)
- Force feedback

# Instruments for MIS

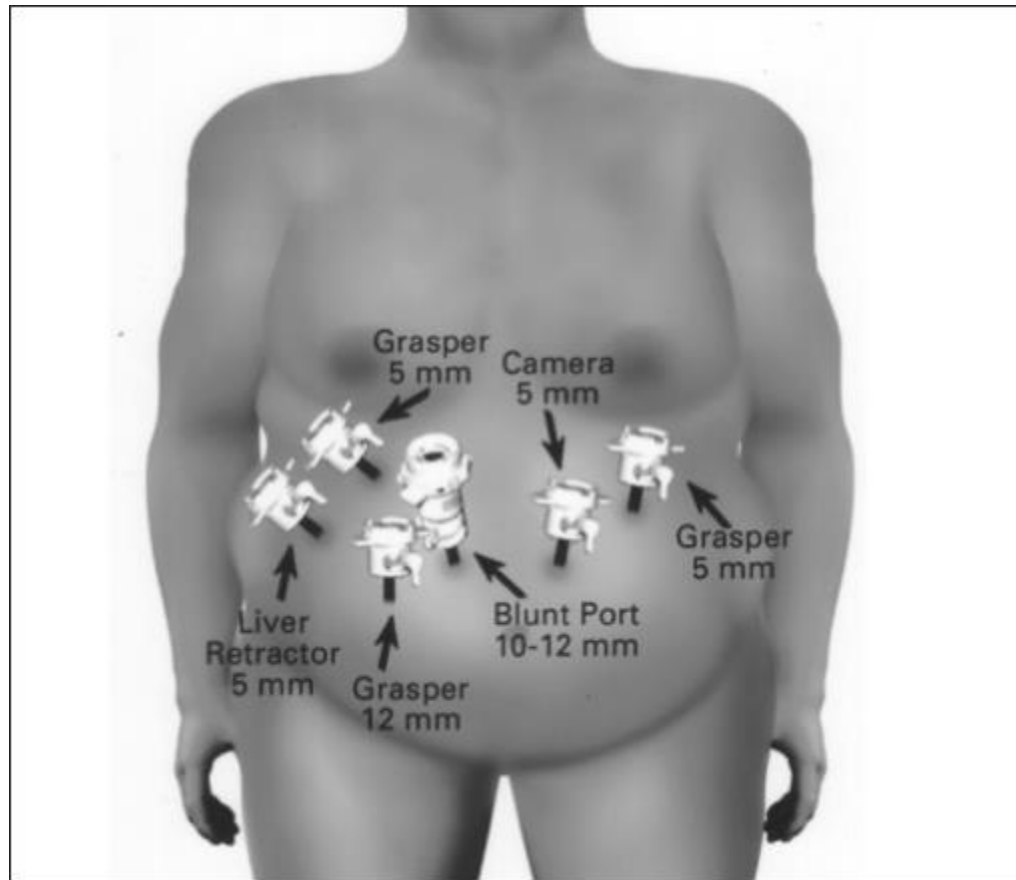


Laparoscopic Grippers



Tools with multiple degree of freedom

# Ports for Gastric bypass surgery



Laparoscopic Roux-en-Y gastric bypass for recalcitrant gastroesophageal reflux disease in morbidly obese patients.  
Perry Y, Courcoulas AP, Fernando HC, Buenaventura PO, McCaughan JS, Luketich JD - JSLs (2004 Jan-Mar)

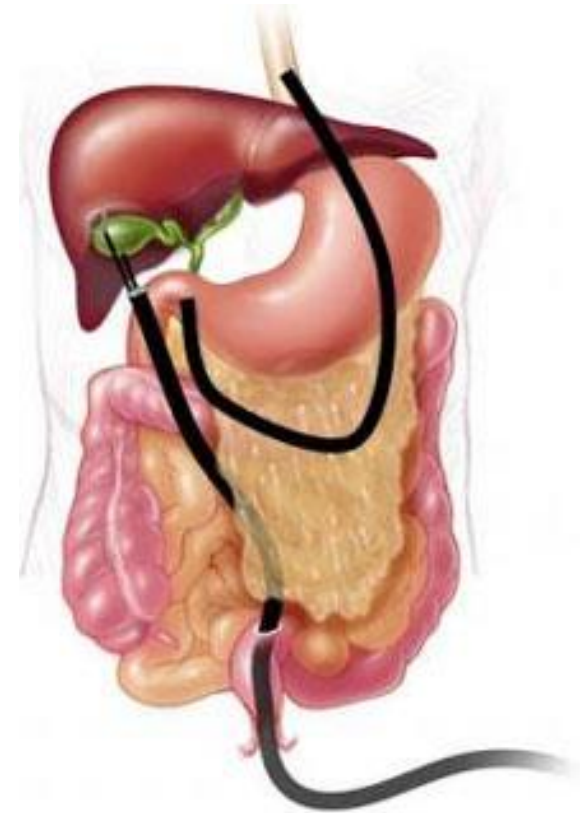


# NOTES

## Natural orifice transluminal endoscopic surgery

surgical technique "scarless"  
abdominal operations can be performed with an endoscope passed through a natural orifice (mouth,anus,urethra etc.) and then making an internal incision

- Only flexible instruments can be used.
- Actuator control by flexible members





**The Anubis platform from Karl-Storz**

World J Gastroenterol. Apr 7, 2011; 17(13): 1655-1665



**Experimental platform from Boston Scientific**

World J Gastroenterol. Apr 7, 2011; 17(13): 1655-1665