

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

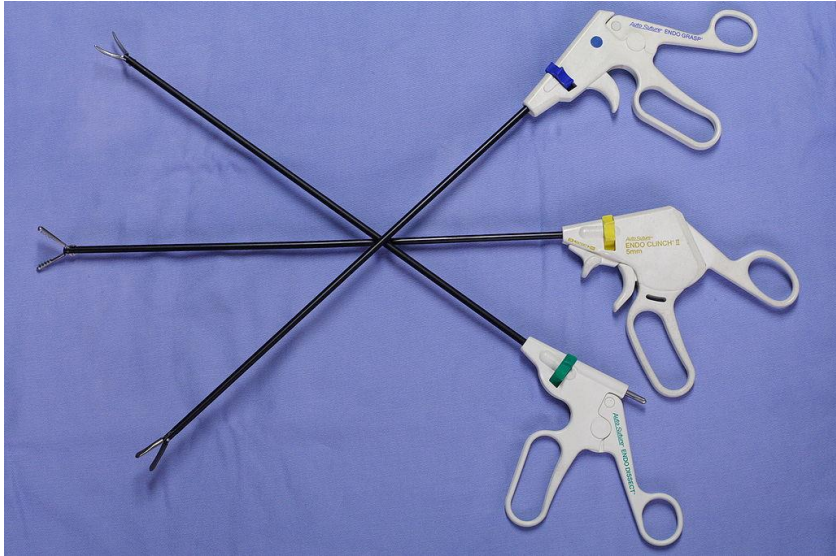
- less chance of infections

- 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 (CO₂)
- Force feedback

Instruments for MIS

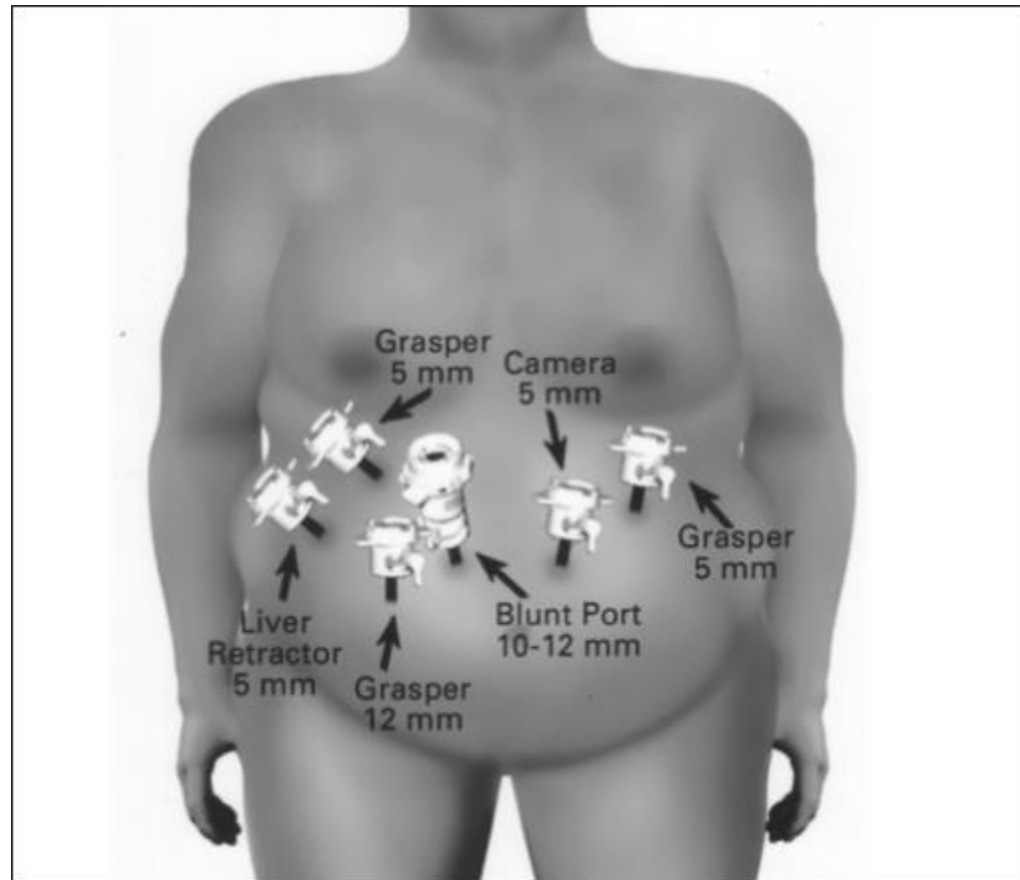


Laparoscopic Grippers



Tools with multiple degree of freedom

Ports for Gastric bypass surgery



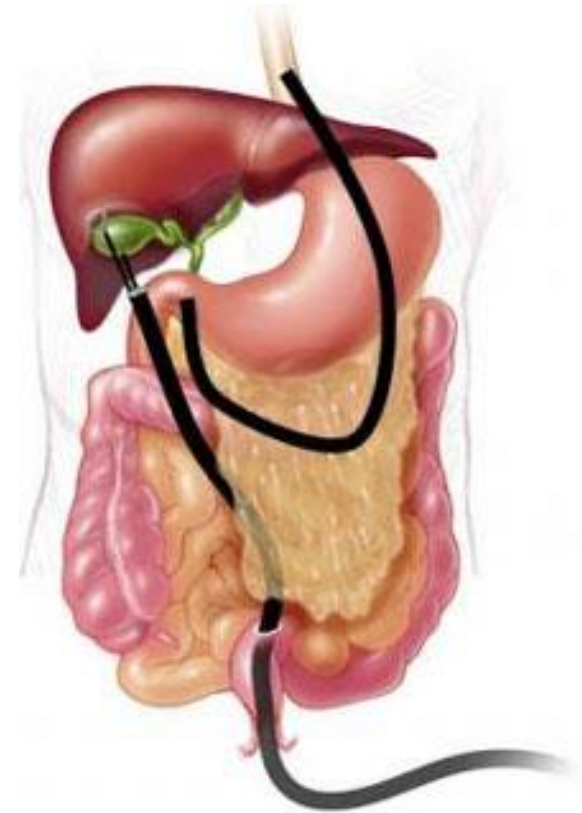
Laparoscopic Roux-en-Y gastric bypass for recalcitrant gastroesophageal reflux disease in morbidly obese patients.
Perry Y, Courcoulas AP, Fernando HC, Buenaventura PO, McCaughan JS, Luketich JD - JSL (2004 Jan-Mar)

NOTES

Natural orifice transluminal endoscopic surgery

surgical technique "scar-less" 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