

# Laparoscopy & Telesurgery

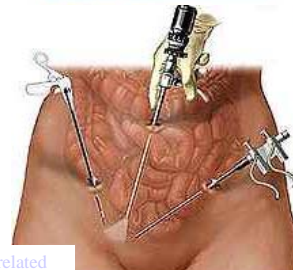
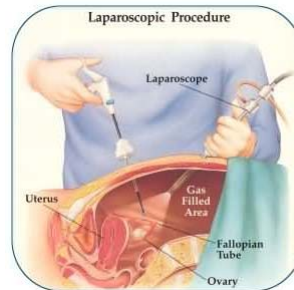


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## Laparoscopy a.k.a. minimally invasive surgery (MIS), keyhole surgery or pinhole surgery

- Operations in the abdomen are performed through small incisions (usually 0.5-1.5cm).
- The key element is the use of a laparoscope: either a telescopic rod lens system or a digital camera is placed at the end of the laparoscope; combined with a light source to illuminate the operative field.
- The abdomen is usually insufflated with carbon dioxide gas to create a working and viewing space. The abdomen is essentially blown up like a balloon (insufflated), elevating the abdominal wall above the internal organs like a dome. The gas used is CO<sub>2</sub>, which is common to the human body and can be absorbed by tissue and removed by the respiratory system. It is also non-flammable, which is important because electro-surgical devices are commonly used in laparoscopic procedures.
- Typical tools are cutting, resection, grasping and clamping tools.
- All tools fulcrum – and thus have “reverse” control



HD tool -- [http://www.youtube.com/watch?v=VKIvZ4eQ\\_4c&feature=related](http://www.youtube.com/watch?v=VKIvZ4eQ_4c&feature=related)

Single port -- <http://www.youtube.com/watch?v=OU1F35b5f3c&feature=related>

Multiple port-- <http://www.youtube.com/watch?v=MAppEy9Umcg>

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## Advantages

There are a number of advantages to the patient with laparoscopic surgery versus an open procedure. These include:

- reduced blood loss, which reduces the chance of needing a blood transfusion.
- smaller incision, which reduces pain and shortens recovery time.
- less pain, leading to less pain medication needed.
- although procedure times may be slightly longer, but hospital stay is less, and often with a same day discharge which leads to a faster return to everyday living.
- reduced exposure of internal organs to possible external contaminants thereby reduced risk of acquiring infections.



## Main risks

- The most significant risks are from trocar injuries to either blood vessels or small or large bowel (Excellent review at <http://www.fda.gov/cdrh/medicaldevicesafety/stamp/trocar.htm>)
- Risk is increased in patients who are obese or have a history of prior abdominal surgery.
- Some patients have sustained electrical burns unseen by surgeons who are working with electrodes that leak current into surrounding tissue. The resulting injuries can result in perforated organs and lead to peritonitis (inflammation of the peritoneum which is the serous membrane which lines part of the abdominal cavity).
- Many patients with existing pulmonary disorders may not tolerate gas in the abdominal cavity, resulting in a need for conversion to open surgery after the initial attempt at laparoscopic approach.
- Not all of the CO<sub>2</sub> introduced into the abdominal cavity is removed through the incisions during surgery. Gas tends to rise, and when a pocket of CO<sub>2</sub> rises in the abdomen, it pushes against the diaphragm (the muscle that separates the abdominal from the thoracic cavities and facilitates breathing), and can exert pressure on the phrenic nerve. This produces a sensation of pain that may extend to the patient's shoulders. For an appendectomy, the right shoulder can be particularly painful. In some cases this can also cause considerable pain when breathing. In all cases, however, the pain is transient, as the body tissues will absorb the CO<sub>2</sub> and eliminate it through respiration.
- Patients can often have trouble walking after surgery for a few days



## Laparoscopy & Technology Development

Laparoscopy is confined, constrained tightly and controlled → lends itself to engineering augmentation

- Visual magnification - use of a large viewing screen improves visibility
- Scope holders (passive arm and active voice controlled robot)
- Force feedback
- Biosensors (oxygenation, ultrasound imaging...)
- Computerized optimal port planning
- Above all, robotics...



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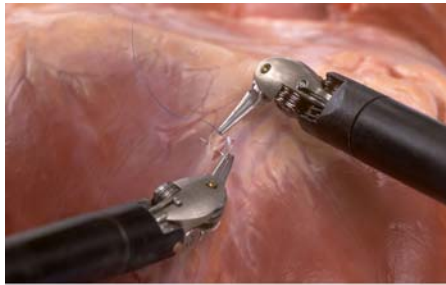
## DaVinci Telesurgery System



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## DaVinci Console



[Play Movie](#)



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## DaVinci problems

Where telesurgery technology is going...

- Killer application has not been found
- Price (over \$1M)
- Large and obtrusive
- Instrument wear and tear (mandatory arm/wrist replacement)
- No force feedback (big problem in grasping and suturing)
- No biosensors (oxygenation)
- No image fusion (pre-op CT with scope view and US)
- Limited field of view (lack of mosaicking)
- No computational image guidance
- No precise inv/forward kinematics (accuracy is 2.5-3 cm)



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