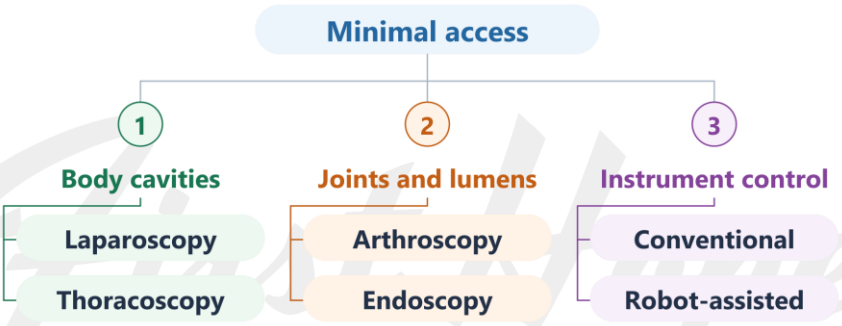
General Surgery - Topic 16 - Minimally invasive General Surgery

Minimally Invasive Surgery

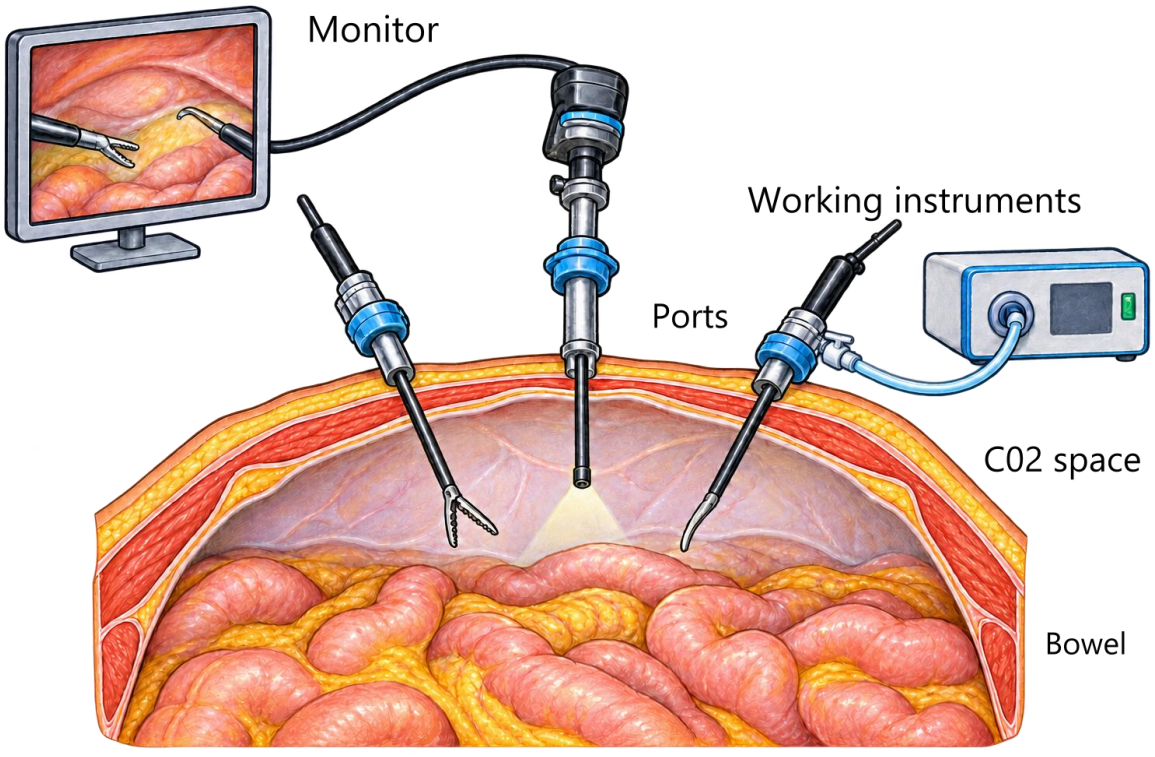
- Minimally invasive surgery uses small access sites and specialized instruments to perform an operation with less disruption of the access tissues.

Meaning and Main Approaches

- The internal operation may still be major even when the skin incisions are small.
- Laparoscopy examines or treats the abdominal cavity through ports and a camera.
- Thoracoscopy uses a similar approach within the chest, while arthroscopy works within a joint.
- Endoscopic procedures use a flexible or rigid scope through a natural opening or a small access route.
- Robot-assisted surgery uses instruments controlled by the surgeon and does not mean that a robot independently performs the operation.



Laparoscopic Equipment and Working Space



Laparoscopy combines a camera, working ports and an insufflated space to provide a magnified operative view

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Essential Components

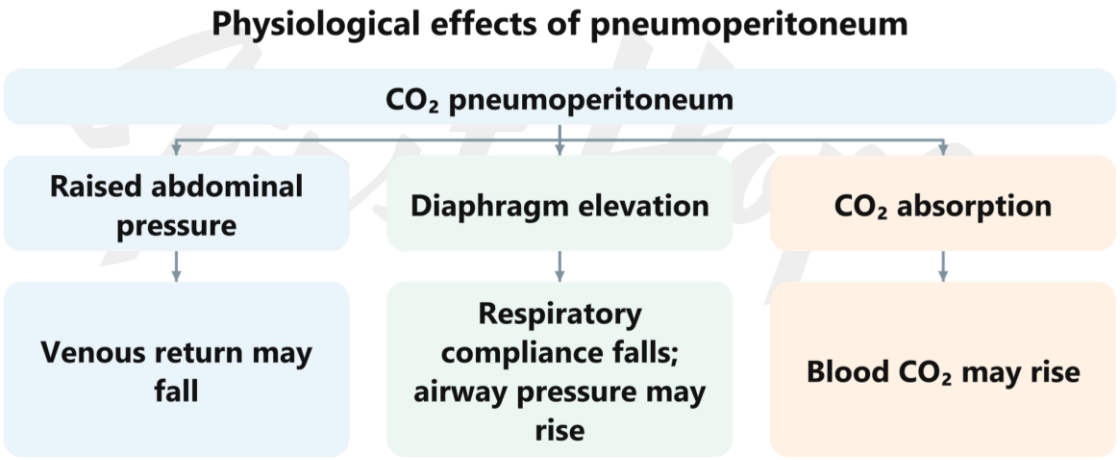
Imaging and Instrument System

- A telescope and camera send an illuminated view of the operative field to a monitor.
- Ports allow the camera and instruments to enter while helping maintain the working space.
- Graspers, dissectors, scissors, suction devices, clips and energy instruments are selected for the operation.

Insufflation and Working Space

- Carbon dioxide is commonly used to create a pneumoperitoneum because it is readily absorbed and does not support combustion.
- The insufflator controls gas delivery, while the anaesthesia team monitors the patient's physiological response.
- The instruments should approach the target at useful angles rather than collide or work directly along the same line.

Physiological Effects



Effects depend on pressure, position, volume status and physiological reserve

Cardiovascular Effects

- Increased abdominal pressure can reduce venous return and alter circulation, especially in an inadequately resuscitated patient.
- The circulatory effect depends on intravascular volume, intra-abdominal pressure, patient position and cardiovascular reserve.

Respiratory and Positioning Effects

- Elevation of the diaphragm reduces respiratory compliance and can increase airway pressures.
- Absorbed carbon dioxide can raise blood carbon dioxide and requires appropriate ventilation and monitoring.
- Steep positioning can further affect breathing, venous pressure, nerves and pressure points.

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- The team uses the lowest pressure that gives an adequate field and adjusts the approach if the patient cannot tolerate it.
- Shoulder-tip discomfort after laparoscopy can result from diaphragmatic irritation, but severe or worsening symptoms need assessment.

Minimally Invasive Surgery: Selection and Outcomes

Indications

1. Diagnostic Uses

- Diagnostic laparoscopy may help when a clinically important abdominal question remains unresolved after suitable non-invasive tests.
- It can assess selected abdominal or pelvic disease, obtain tissue or determine whether a cancer is suitable for resection.
- It should answer a defined clinical question rather than replace a careful history, examination and appropriate imaging.

2. Therapeutic Uses

- Common operations include cholecystectomy, appendicectomy and selected hernia repairs.
- Other examples include selected colorectal resections, bariatric operations, adrenal surgery and anti-reflux surgery.
- Selected emergencies, including some perforations or bowel obstruction, may be managed laparoscopically by an experienced team.
- The underlying indication for treatment remains important; the availability of a camera is not itself an indication for surgery.

Assessing Suitability

- Consider haemodynamic stability, cardiopulmonary reserve, coagulation, abdominal distension and previous operations.
- Assess whether the disease can be treated safely through the proposed approach and whether appropriate expertise and equipment are available.
- Dense adhesions, distorted anatomy or a very large lesion can make access and dissection difficult.
- Previous abdominal surgery, obesity and pregnancy are not automatic absolute contraindications, but they may require modified planning and experienced care.
- Uncontrolled shock or inability to tolerate the required physiology may make a rapid open or other approach safer.
- Correct reversible problems and discuss alternatives before proceeding when the clinical situation allows.

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Advantages and Limitations

Potential benefit	Corresponding limitation or risk
Smaller access wounds may reduce pain.	Internal injury can still occur despite small scars.
Magnification can improve detail.	Incorrect anatomical interpretation can still cause serious injury.
Earlier recovery is possible in suitable cases.	Complex disease or complications can prolong recovery.
Specialized instruments expand options.	They require training, maintenance and reliable backup.

Potential Advantages

- Smaller access incisions often reduce wound pain and the burden of wound complications.
- Many suitable patients regain mobility and return to normal activities sooner.
- Magnification can improve the view of small structures when the camera is clear and the anatomy is recognized correctly.
- A shorter hospital stay may reduce disruption to the patient and family.
- The size of these benefits depends on the operation, patient and quality of perioperative care.

Technical and Service Limitations

Instrument Feedback and Technical Skills

- The surgeon has less direct tactile feedback and must judge depth from the available imaging system.
- Instruments pivot at the port, creating movements that require specific training and hand-eye coordination.
- Complex operations can take longer during the learning phase.

Equipment, Staffing and Robotic Limitations

- Equipment purchase, maintenance, disposables and trained staff add costs.
- Device failure or unavailable expertise can prevent completion of the intended approach.
- Robotic systems may improve instrument articulation in selected operations, but higher cost does not automatically mean a better outcome for every patient.

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Minimally Invasive Surgery: Complications and Aftercare

Complications and Warning Signs

1. Access-Related Injury

Mechanism and Recognition

- Initial entry can injure bowel, a solid organ or a major blood vessel.
- The access method and site should be chosen after reviewing scars, anatomy and the planned procedure.
- No entry technique removes all risk, so the team must recognize and respond to an injury promptly.

Response to Suspected Injury

- A suspected injury may require immediate repair, extra access or conversion to an open operation.
- A prompt change of approach is preferable to continuing through poor exposure or uncontrolled bleeding.

2. Dissection and Energy Injury

- Bleeding, duct injury, bowel injury and thermal damage can occur during the internal operation.
- Thermal injury may present after an initially reassuring postoperative period because tissue damage can evolve.
- Keep instrument tips visible, use controlled energy application and identify structures before dividing them.
- A clear view of a structure is not the same as correct anatomical identification.

Critical View of Safety

- During cholecystectomy, the critical view of safety helps identify the structures entering the gallbladder before division.
- The hepatocystic triangle is cleared, the lower third of the gallbladder is separated from the liver to expose the cystic plate, and only the cystic duct and cystic artery should be seen entering the gallbladder before division.
- This check concerns correct anatomical identification and does not require routine dissection of the common bile duct.
- If safe identification is not possible, pause, seek assistance and use an appropriate imaging or bailout strategy.

3. Gas, Positioning and Wound Problems

- Pneumoperitoneum can cause cardiovascular or respiratory disturbance and, rarely, gas embolism.

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