FUNDAMENTALS OF ROBOTIC SURGERY

A GUIDE FOR WARWICK MEDICAL STUDENTS

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Purpose of the Booklet

This guide is written to help medical students at Warwick Medical School understand the basics of robotic surgery. During your surgical placement at University Hospital Coventry and Warwickshire (UHCW) you will see a variety of operations being performed with Da Vinci X and Xi robotic systems including urology, upper GI, colorectal, HPB, gynaecology, ENT, and thoracic surgery.

Robotic surgery can seem complex if you have not seen it before. The equipment looks different, the way the team works is unique, and the technology can feel overwhelming. The aim of this booklet is to explain how robotic surgery works in a clear and easy to follow way. You will learn about the da Vinci X and Xi systems used at UHCW, what each part does and how the surgical team works together in the robotic theatre.

This guide will help you understand what is happening when you watch an operation. It will show you the benefits of robotic surgery, what makes robotic surgery different from open or laparoscopic surgery and what to look out for in theatre. It will also introduce you to how robotic surgery is developing in the future and how you as a medical student can get involved with learning, research, or even a future career in robotic surgery.

The goal is simple, to help you make the most of your time in theatre, feel more confident about what you are observing and spark your interest in the exciting world of surgical technology.

Enjoy the future of surgery … Robotic!

Jawad Ahmad
August 2025

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How to Use This Guide

This guide is designed to support you before, during and after your surgical placement at UHCW. You do not need to read it all in one go. You can dip into the sections that are most helpful for you at different stages of your placement

- Before theatre: Read the introduction and the basics about how robotic surgery works. This will help you understand what you are going to see in theatre
- During theatre: Use the sections on theatre set up, the surgical team and what to look for during the operation. This will help you follow what is happening and make sense of the screens, instruments and movements
- After theatre: Read the sections on post-operative care, reflections and future developments. This will help you understand how robotic surgery fits into patient care and what opportunities exist for you to get involved in the future

Chapter 1: Introduction & Foundations

Introduction to Robotic Surgery

History & Evolution

If you think robotic surgery is something out of a sci-fi film, you are not far off, except the "robots" don't operate on their own, and no one's being patched up by R2-D2, yet!

The story begins in the 1980s, when surgeons and engineers started playing with the idea of using machines to help with operations. One of the first was the PUMA 560 robot, originally built for industrial use. In 1985, it was used to guide a needle into a patient's brain for a biopsy, an incredible leap in precision for the time.

A few years later, the US military became interested. Their goal was to operate on injured soldiers from far away, even from another continent so that "*surgeons could operate in the battlefield from the comfort of their home*". This sparked early work on telesurgery, basically the idea that a surgeon in one place could control a robot in another and operate on a patient where expertise don't exist locally

By the 1990s, public hospitals got involved. AESOP system, a voice-controlled robotic arm for holding a laparoscopic camera was the first to make its way in the clinical practise. It could follow simple voice commands like left, right, zoom, which must have made surgeons feel a bit like starship captains. Then there was the ZEUS robot, which could actually manipulate instruments for surgery.

But the real turning point came in 2000 when the Da Vinci Surgical System received FDA approval. For the first time, surgeons could sit at a console, see the inside of the body in magnified 3D-HD and control tiny instruments that moved more like their own hands but without the shake of a tired wrist

Since then, robotic surgery has grown fast. The systems have become smaller, quicker to set up and better integrated with imaging and data. When you see the robotic systems at work at UHCW, you will appreciate how we got from an industrial arm in the 80s to today's sleek, high-tech systems gives you a better appreciation for the technology and for just how quickly surgery is evolving.

Fun fact: The "da Vinci" name comes from Leonardo da Vinci, who designed some of the first known robots, and drew incredibly detailed anatomical sketches

Why Robotic? Benefits & Limitations

So why bother with all this expensive robotic equipment when surgeons have been doing operations perfectly well with scalpels and steady hands for centuries? The answer is that robotic surgery takes some of the best parts of traditional open surgery and laparoscopic (keyhole) surgery and puts them together in one package.

In open surgery, the surgeon has full access to the patient, can use their hands freely, and can feel the tissues directly. But the trade-off is a larger incision which usually means more pain, a longer hospital stay and a slower recovery.

Laparoscopic surgery changed all that in the late 20th century. Small incisions, a camera inside the body, and long instruments made it possible to operate with much less trauma. Patients loved it, but it brought new challenges for surgeons. Working with rigid sticks in a small space can be awkward. The image is flat and two-dimensional. Instruments can only move in straight lines and pivots, so complex suturing or fine dissection can be tricky. And it's hard on the surgeon's body to stand and twist in awkward positions for hours.

Robotic systems were designed to deal with these challenges. The surgeon sits comfortably at a console, looking into a magnified three-dimensional image. The instruments have wrist-like joints that can move in all directions, far more freely than rigid laparoscopic tools. Tremors from the surgeon's hands are filtered out. Movements can be scaled down so that a large movement by the hand becomes a tiny precise movement at the instrument tip.

For patients, the potential benefits are significant; smaller scars, less pain, reduced blood loss, faster recovery and in some cases better long-term outcomes. For students, the learning opportunities are huge. The high-definition camera shows anatomy more clearly than you might ever see during an open case, and you can follow every movement in detail

That said, robotic surgery isn't perfect. It's expensive to buy and maintain, and the systems take time to set up before surgery can start. There's no tactile feedback, so surgeons rely entirely on what they can see (visual feedback). And while the console surgeon is controlling the instruments, an assistant still needs to be at the patient's side for tasks like suction, stapling, and specimen removal.

In short, robots don't replace the skill of the surgeon or the teamwork in theatre — they just give everyone a new set of tools to work with.

Fun fact: Robot is a glorified surgical instrument. It is a tool, not a surgeon!

Table 1: Benefits and Limitations of Robotic Surgery

	Benefits	Limitations
View	3D-HD image with x10 magnification	No tactile feedback, surgeon has to rely on visual Feedback
Movement	Wristed instruments that can bend, rotate, and move like the human hand, With 7° of freedom	Instruments are a fixed size which can be a problem in very small anatomical spaces.
Ergonomics	Surgeon operates while seated at a console, reducing strain during long cases, which may prolong the surgical carrier	Console surgeon is away from the patient, the assistant must manage bedside tasks
Precision	Tremor filtration and motion scaling allow very fine movements and accurate suturing	Systems take time to set up and dock, especially for less experienced teams.
Patient Recovery	Smaller incisions can mean less pain, less blood loss, and shorter hospital stays	Outcomes depend heavily on the surgeon's experience and the complexity of the case
Teaching	Dual consoles let trainees and trainers work together without risk to the patient	Theatre time for robotic training is limited and competitive
Cost	Cost savings due to shorter hospital stay, lower wound related complications and early recovery and return to normal activities	High purchase price and ongoing maintenance costs not available in all hospitals

Overview of the da Vinci X and Xi Systems

The da Vinci Surgical System is essentially a set of highly advanced tools designed to give the surgeon better vision, dexterity, and control during minimally invasive surgery. It doesn't replace the surgeon; it's more like an extension of their hands and eyes

Both the da Vinci X and da Vinci Xi are part of the fourth generation of these systems. They share the same core idea: the surgeon sits at a console, away from the patient, looking into a 3D, high-definition viewer. Inside the patient, slim robotic arms hold a camera and delicate instruments that can bend and twist in ways far beyond the limits of standard laparoscopic tools. The surgeon's hand movements at the console are translated into scaled, tremor-free movements of the instruments inside the patient's body

From a student's perspective, this means two things. First, you get a crystal-clear view of anatomy on the theatre monitor, far better than you'll ever get peering over a shoulder during open surgery. Second, you see the kind of precision work that makes these systems valuable: fine dissection, careful suturing, and smooth instrument changes.

The differences between the X and the Xi aren't in the basic controls or imaging — those are equally good. It's more about flexibility, positioning, and certain extra features that make the Xi more adaptable to complex or multi-quadrant surgery.

The da Vinci X systems

The da Vinci X was introduced as a more cost-conscious way for hospitals to expand their robotic surgery programmes without investing in the top-of-the-line Xi system

It still has the same 3D, high-definition vision and the same wristed instruments. The controls at the console are identical, so a surgeon trained on one can operate the other without any extra learning curve. For many procedures, especially those that stay in one area of the body, the X performs just as well as the Xi.

The main differences lie in the patient cart and arm configuration. The X uses a side-docking arrangement. That means the arms are brought in from the side of the operating table rather than overhead. This works perfectly for operations in areas like the pelvis (for urology and gynaecology) or upper abdomen (for certain general surgery procedures). However, if the surgeon needs to operate in different areas of the abdomen during the same case, the robot may need to be undocked and repositioned.

You will also notice that the camera arm isn't mounted on an overhead boom, so sometimes the patient needs to be repositioned during surgery rather than just moving the arms. This adds a few minutes to the operating time, but in a focused, single-quadrant procedure, it's rarely an issue

In theatres, the X is often found in hospitals building up their robotic surgery capacity or in specialty theatres dedicated to one type of operation. If you're watching an X case, pay close attention to the initial setup and docking — this is where you'll see the teamwork between the console surgeon, bedside assistant, scrub nurse, and operating department practitioners.

Figure 1 da Vinci X System

The da Vinci Xi system

The da Vinci Xi is the flagship system. It's designed for maximum versatility and is especially suited for cases where the surgeon needs to move between different quadrants of the body without undocking

The most noticeable difference is the overhead boom design. Each of the four arms is mounted on a rotating boom that can be positioned anywhere around the patient. This means the surgeon can operate in the pelvis, move to the upper abdomen, and even work in the chest without having to redock the robot

Another feature is integrated table motion. With the Xi, the operating table can be tilted or adjusted during surgery without detaching the arms — useful when you need to change the patient's position to get better access or exposure

The arms themselves are slimmer and longer than earlier models, reducing the risk of clashing outside the body. The camera can be plugged into any arm, so the surgeon can quickly change the viewing angle without physically moving the arms much. The targeting system, which aligns the arms with the planned incision sites, is faster and more automated, so docking can be quicker

In theatre, you'll often see the Xi used for complex procedures such as HPB, colourectal, upper GI resections, multi-organ surgery, and cases involving multiple abdominal quadrants. For students, this is a great chance to watch how the team adapts the arm positions and how the flexibility of the system can speed up what would otherwise be a long and awkward laparoscopic operation.

Whether you're watching an X or an Xi, remember: the robot isn't doing the surgery. The surgeon is still making every decision and every movement — the technology simply allows those movements to be more precise, controlled, and minimally invasive. Your job as a student is to observe not just the "wow factor" of the machine, but also how the team works around it to keep the patient safe and the operation running smoothly.

Fun Fact: No coffee breaks needed: While the surgeon can (and should) take breaks during a long operation, the robot never gets tired. Its movements are just as steady at the end of a six-hour case as they are at the start- Fundamental Concepts

Figure 2 da Vinci Xi System

Robotic vs Laparoscopic vs Open Surgery

When you stand in theatre it can be easy to forget that surgical techniques have evolved in big leaps over the past century

Open surgery was the standard for generations. A big incision, direct view of the anatomy, the ability to use both hands freely and feel the tissues directly. The saying was “big surgeons make big incisions”. It is still the gold standard for certain emergencies or situations where full exposure is essential. The downside is the larger wound, which usually means more discomfort after surgery, longer hospital stays and more time off normal activities

Laparoscopic surgery changed the picture in the late 20th century. Instead of a long incision, a camera and instruments are inserted through small cuts. The surgeon sees the inside of the body on a monitor and uses rigid tools to work through narrow spaces. This approach reduces pain and recovery time but the image is flat and the instruments have limited movement. It can be physically demanding for the surgeon to stand and twist for hours.

Robotic surgery combines the best parts of both. Small incisions like laparoscopy, but with wristed instruments that move like a human hand and a 3D magnified image that gives depth perception. The surgeon operates from a console in a comfortable seated position, moving controls that translate into precise, tremor-free movements inside the patient. It is not faster or automatically better for every operation, but in the right case it can give both patient and surgeon clear advantages

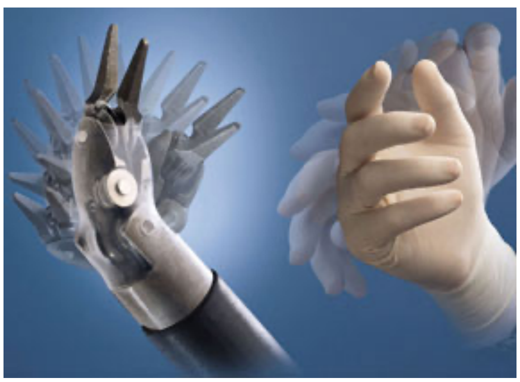
Fun fact: The very first robotic surgical systems were partly developed with funding from NASA, with the idea that one day a surgeon could operate on an astronaut in space without leaving planet Earth

Basic Physics and Technology

The robotic arms are the heart of the system. Each arm is mounted on the patient cart and controlled by the surgeon at the console. The arms move smoothly due to advanced motors and control software that translate the surgeon’s movements into smaller, exact motions. One arm holds the camera and the others hold instruments such as scissors, graspers or needle drivers.The instruments are known as EndoWrist tools. They have joints that mimic and even exceed the movement of the human wrist. This extra range of motion means the tip can approach tissue from angles impossible with rigid laparoscopic tools. The surgeon can also rotate and pivot the tips while keeping the shaft steady inside the patient. The 3D vision system uses a dual-lens endoscope to give depth perception. The image is magnified up to ten times so structures like blood vessels or nerve bundles are easier to identify and avoid. Some systems can switch between normal light and near-infrared fluorescence mode when a special dye is injected, making certain structures glow. Tremor reduction is built into the system. Even the steadiest human hand has tiny involuntary movements. The robot filters these out automatically, so the tips move in a perfectly smooth line. This is particularly helpful for tasks like suturing in confined spaces.

Fun fact: The first transatlantic surgery (Operation Lindbergh in 2001) was performed by a surgeon in New York on a patient in France through a da Vinci robotic system

Figure 3 endowrist



Ergonomics in Robotic Surgery

One of the less obvious advantages of robotic surgery is how it changes the physical demands on the surgeon. In open or laparoscopic surgery, the surgeon often stands for hours, twisting or leaning to get the best view. This can lead to neck, back and shoulder strain over a career.

In robotic surgery the surgeon sits at a console with their arms supported and their head in a viewer. The controls are designed to be used in a natural, relaxed position. Foot pedals control the camera and energy devices without awkward reaching. The seated posture and balanced arm positions can reduce fatigue and make long operations more manageable. Better ergonomics do not just benefit the surgeon, a less tired surgeon may be more consistent throughout a long case, which can make a difference for the patient too.

It also means that older and more senior surgeons or those with physical strain from years in practise can continue operating for longer in their careers.

Fun fact: With the reduced strain of working at the robotic console, some surgeons joke they might still be operating happily in their late sixties or seventies

Figure 4 Surgeon sitting comfortably on the console

Surgeon Console 1 Surgeon Console 2 Patient Cart Vision Cart

Components of the da Vinci System

Surgeon Console

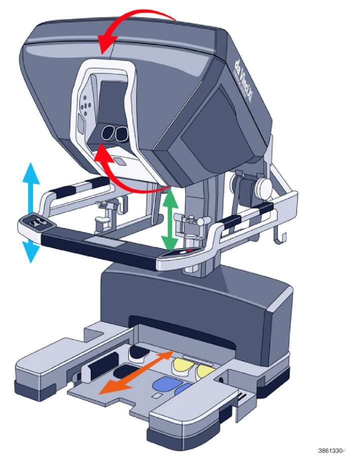
The surgeon console is the heart of the da Vinci system and it is where every movement begins. From the outside it looks like a large, high-tech workstation but when you sit down it feels surprisingly natural. The surgeon rests their arms on padded supports and places their head inside the viewer. Inside the viewer is a three-dimensional high-definition image of the surgical field and it feels almost like stepping into the patient’s anatomy. The camera view is magnified so even small structures like lymphatic vessels or fine nerve branches are clear and easy to follow.

Two hand controllers are shaped to fit comfortably in the surgeon’s hands. Moving them feels much like holding small joysticks but each movement is scaled down so a large motion of the hand becomes a tiny, precise motion of the instruments inside the patient. This scaling can be adjusted depending on the task. For example, making larger sweeps during tissue dissection and ultra-fine movements when placing sutures near delicate structures. The console’s foot pedals give the surgeon extra control without breaking concentration. They can switch between camera and instruments, activate energy devices for cutting or sealing, and clutch the hand controls to change position without moving the tips inside the body.

A dual console setup is sometimes used for training or complex cases. In this arrangement two surgeons can share control of the instruments or the camera and hand over instantly when needed. For students, this is particularly interesting because you can see how an experienced surgeon guides a trainee in real time while still keeping the patient safe.

The console is designed with ergonomics in mind. The seated posture, the arm and head supports, and the balanced position of the controls all help reduce physical strain. In open or laparoscopic surgery a long case can leave the surgeon’s shoulders aching and their neck stiff. At the console, the body stays more relaxed and the focus can remain entirely on the operation.

Fun fact: Trainees often spend hours on a da Vinci virtual simulator connected to the console before touching a real patient and the experience is so realistic that many forget they are working on a computer model



Patient Cart

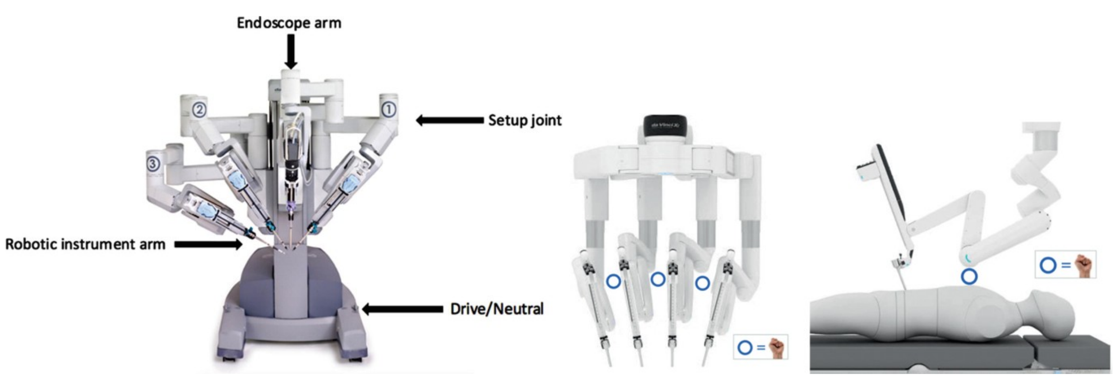
The patient cart is the part of the system that sits right next to the operating table and connects directly to the patient through surgical ports. It holds the four robotic arms which are the working limbs of the system. One arm carries the camera and the others carry instruments. The design of the arms allows them to move smoothly and precisely in multiple directions without shaking or drifting.

Each arm has several joints that allow it to pivot, rotate, and extend and these are controlled entirely by the surgeon at the console. The scrub nurse or assistant attaches and changes the instruments on the ends of the arms during the case. This can include swapping a grasper for scissors or replacing a needle driver with a stapler. The instruments click into place quickly and the system recognises them automatically

The way the cart is positioned depends on the system model. With the da Vinci X, the cart is usually docked from the side of the operating table and this works well for single-quadrant surgeries such as pelvic operations in urology or gynaecology. The da Vinci Xi has an overhead boom that allows the arms to come from almost any direction which is useful for multi-quadrant surgery where the operative field moves from one area to another.

Positioning and docking the cart is a precise process. The arms must be lined up so they reach comfortably without clashing with each other or bumping into members of the surgical team. The joints allow a wide range of motion but they also have safe limits so nothing presses too hard on the patient's body wall. This is why you will see the team spend several minutes adjusting angles and arm lengths before the surgeon even sits down at the console.

Fun fact: The robotic arms can move with a precision measured in fractions of a millimetre and they can hold that accuracy for hours without fatigue, something even the steadiest human hand cannot match



Vision System

The vision system is what gives robotic surgery one of its biggest advantages over both open and laparoscopic approaches. A dual-lens endoscope captures the image from inside the patient and sends it to the console's viewer. This creates a true three-dimensional picture that gives the surgeon natural depth perception. The image is bright, clear, and magnified up to ten times, so even small anatomical details become visible.

In standard mode the camera shows a high-definition colour image of the tissues. On some systems the surgeon can switch to fluorescence imaging mode (Fire Fly mode) using near-infrared light. This is done after a special dye called indocyanine green (ICG) is injected into the patient. In fluorescence mode, blood vessels, lymphatic channels, or bile ducts will glow on the screen, making them easier to identify and protect. This technology can help avoid injury to important structures and confirm blood flow in vessels during reconstruction.

The surgeon can control the camera angle, focus, and zoom entirely from the console without relying on an assistant to hold and move it. The camera arm is as steady as the rest of the system and it can rotate smoothly to change the perspective. In the da Vinci Xi, the camera can be plugged into any of the four arms so the field of view can shift to a completely different angle without undocking.

Fun fact fluorescence mode is equivalent of night-vision goggles, except here it can mean the difference between finding a hidden vessel and missing it

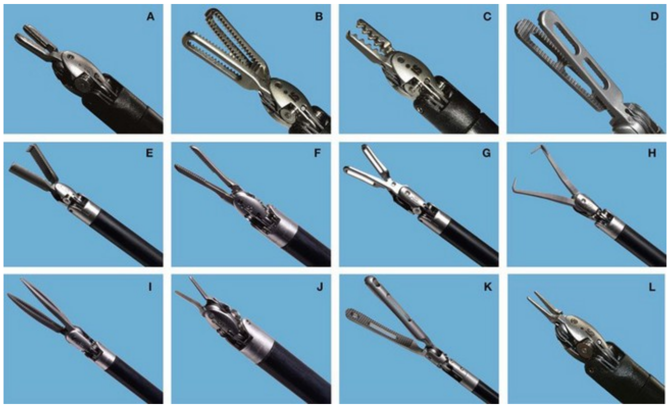
Instruments and Accessories

The EndoWrist instruments are the da Vinci system's hands inside the patient. Each one is designed with tiny joints at the tip that can bend and rotate like a human wrist and often go further. This extra freedom of movement allows tasks such as suturing deep inside the pelvis or dissecting around curved structures that are almost impossible with straight laparoscopic tools.

There is a wide range of instruments for different purposes. Needle drivers hold and pass sutures. Maryland bipolar forceps can grasp and apply energy to seal vessels. Monopolar curved scissors cut with precision while applying energy to control bleeding. There are clip appliers, staplers, suction and irrigation devices, and energy sealing instruments. Each instrument is designed for a specific role and the scrub nurse or assistant changes them as needed during the case.

The system tracks how many times each instrument has been used and most have a limit of around ten uses before they must be replaced. This ensures the joints remain smooth and the cutting edges sharp. Accessories such as camera cleaning devices and port seals also keep the system working efficiently throughout the operation.

Fun fact: Some EndoWrist instruments can spin their tips in a full circle continuously without stopping, something no human joint can do. This makes suturing in confined spaces much easier



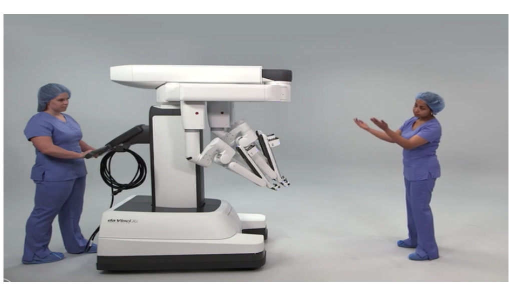
Setup and Docking

Setting up and docking the da Vinci system is a team effort. Before the patient arrives in theatre, the system is checked, powered on, and moved into position. Once the patient is anaesthetised and the surgical ports are placed, the patient cart is brought up to the table. The arms are positioned so that they align perfectly with the ports.

The camera arm is usually connected first so the surgeon can see inside the patient. Then the other arms are connected to their instruments. Each arm is adjusted to avoid clashing with the others or with the assistant. In the Xi model, the targeting system helps align the arms automatically based on where the surgeon plans to operate.

Docking can take anywhere from a few minutes with an experienced team to longer if the case is complex or the positioning is unusual. During this time, communication is key — the console surgeon guides the bedside team while they make adjustments. Once docking is complete, the surgeon takes their place at the console and begins the operation.

Fun fact: A highly trained robotic surgical team can dock the system in under five minutes and the coordination looks a lot like a Formula One pit crew changing tyres in record time



The Surgical Team

Roles

Robotic surgery is never a one-person job. Even though the surgeon controls the robotic arms from the console, a full team is needed in theatre for the operation to run safely and smoothly.

Surgeon

The surgeon at the console is responsible for the operation from start to finish. They control the camera and the instruments, making every movement inside the patient. In many ways, their role is the same as in open or laparoscopic surgery, they plan the procedure, carry it out, and deal with any unexpected issues. What changes in robotic surgery is their physical position. Instead of standing by the operating table, they are seated at the console a short distance away.

Assistant

The assistant stands at the patient’s side. Their role is vital because there are still many things the robot cannot do. The assistant handles tasks such as suction, passing sutures, stapling, retracting tissue, and removing specimens. They also change the instruments on the robotic arms as needed. In some cases, the assistant is a fellow surgeon who can take over quickly if the procedure needs to be converted to open surgery.

Scrub nurse

The scrub nurse is the guardian of sterility and the keeper of the instruments. They prepare all the robotic instruments, load them onto the arms, and pass any other tools the assistant may need. They also monitor how many uses each instrument has left so that nothing reaches the end of its life mid-procedure.

Anaesthetist

The anaesthetist manages the patient’s safety and comfort throughout the operation. In robotic surgery, this can be more challenging because the patient is often in a fixed position with the robotic arms docked over them. This means any change in access to the airway or IV lines has to be planned in advance. The anaesthetist monitors the patient’s vital signs, manages anaesthesia depth, and keeps the patient stable during any changes in position.

Fun fact: Once the robot is docked, the anaesthetist becomes the patient’s lifeline, they are the only one with a clear path to the head and airway for the rest of the operation

Communication and Workflow in a Robotic Theatre

Robotic surgery changes the way the team communicates because the surgeon is not physically at the patient's side. Instead, they are looking into the console, with their hands and feet on the controls. This makes clear, deliberate communication even more important.

Before the case starts, the team has a briefing. This covers the type of procedure, patient details, positioning, which instruments will be needed, and whether the X or Xi system will be used. The plan for docking is discussed so everyone knows where to stand and move during setup.

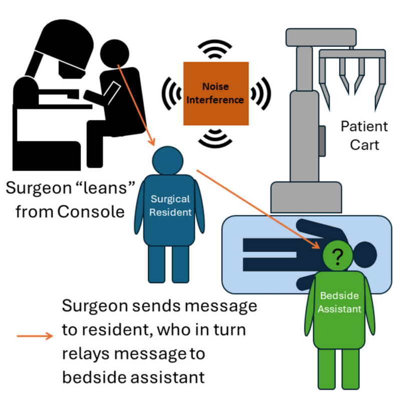
During docking, the console surgeon usually stands with the assistant to help align the arms. Once everything is in place, they move to the console. From this point on, instructions from the console need to be clear and specific because the surgeon cannot simply point to what they mean. The assistant may respond verbally or by repeating back the instruction to confirm it.

The scrub nurse plays a central role in keeping the flow smooth. They anticipate the next instrument change and prepare it in advance. The anaesthetist is in constant quiet communication with the rest of the team if any adjustments are needed for patient safety.

If there is a dual console, communication can also happen between two surgeons, which is especially useful for teaching or complex cases. In this setup, the workflow can be even more dynamic, with one surgeon controlling the camera while the other works with the instruments.

At the end of the case, docking is reversed — arms are undocked, instruments removed, and ports taken out. The team then does a debrief, noting what went well and what could be improved.

Fun fact: In robotic surgery the communication between the surgeon and the assistant often follows a NASA "readback" style, where instructions are repeated back word-for-word to avoid any misunderstanding



Core Concepts in Robotics

Port Placement Principles

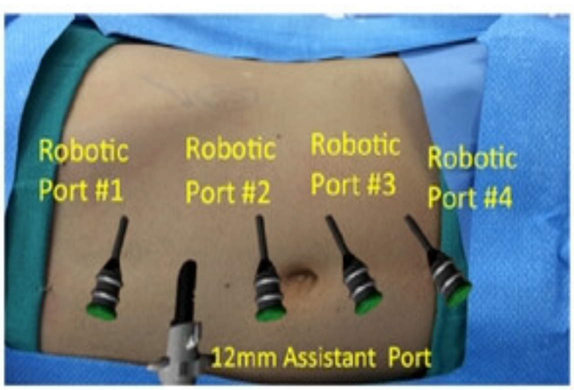
Getting the port placement right is one of the most important steps in robotic surgery. The ports are the entry points for the camera and the instruments, and if they are in the wrong place the surgeon will have a harder time working efficiently. Poor placement can limit the range of motion, cause the robotic arms to clash, and even increase the risk of injury to the patient.

The ideal port layout depends on the target anatomy, the patient's body shape, and the type of procedure. The camera port is usually placed first and it becomes the reference point for the other ports. For the da Vinci X, the side-docking setup means the ports often need to be in a slightly curved line across the abdomen. For the da Vinci Xi, the ports can be arranged in a straighter line because the overhead boom gives more flexibility in approach.

Each instrument port must be placed far enough apart, typically eight centimetres or more, to prevent the arms from clashing outside the body. Inside, the tips of the instruments should meet at a comfortable working angle, usually between 30 and 60 degrees. Extra care is taken in patients with smaller frames where there is less space to work.

Marking the ports before the patient is draped allows the team to check spacing and adjust if necessary. This is one of the moments where the console surgeon and the assistant work closely together to visualise the planned movements before any incision is made.

Fun fact: Port placement is like parking cars in a tight garage, if you get the spacing wrong at the start, you will spend the whole operation bumping and clashing into things



Docking and Troubleshooting

Docking is the process of bringing the patient cart up to the table and connecting the robotic arms to the ports. In the da Vinci X, docking from the side requires careful alignment so the arms can reach the target without overstretching. In the Xi, the targeting system can automatically align the arms once the camera port is identified, making the process faster

During docking, the assistant ensures the arms are positioned so they have a full range of motion without touching each other. The scrub nurse helps by loading the correct instruments on each arm. The anaesthetist confirms that all lines and the airway are secure because once the robot is docked, access to the patient is limited.

Troubleshooting during docking is mostly about avoiding and correcting arm collisions. If an arm is at the wrong angle, it can be unlocked and repositioned. Sometimes a port needs to be moved if the spacing is too tight. On rare occasions, a problem with a robotic joint or instrument recognition will require swapping out the instrument or even undocking.

An experienced team anticipates these issues. This is why the same surgical staff working together regularly can make docking much faster and smoother.

Fun fact: The fastest recorded docking times for the da Vinci Xi in some training centres are under two minutes — a level of speed and precision that feels more like a motorsport pit stop than an operating theatre.

Instrument Changes and Energy Modalities

Robotic instruments are highly specialised and each is designed for a specific task. Some are for grasping and holding tissue, some for cutting, and some for suturing. The scrub nurse or assistant changes the instruments during the operation, which can happen frequently, especially in complex cases. Each instrument clicks into the robotic arm and is recognised automatically by the system, which tracks how many uses it has left before replacement.

Energy modalities are built into many instruments. Monopolar energy is delivered through a single electrode and uses the patient's body as part of the electrical circuit. It is effective for cutting tissue but needs careful use to avoid spreading heat to nearby structures. Bipolar energy passes current between two tips on the same instrument, making it more precise for sealing vessels. Vessel sealers are larger instruments designed to seal and divide bigger blood vessels, often in one step.

The surgeon selects which modality to use based on the task. For example, monopolar scissors for sharp dissection, bipolar forceps for precise sealing, and a vessel sealer for dividing major pedicles. Switching between these is quick from the console because the foot pedals control which energy source is active.

Fun fact: Some surgeons describe using different energy modes as having a whole set of surgical “superpowers” available at the touch of a foot pedal

Table 2: Comparison of Open, Laparoscopic and Robotic Surgery

	Open Surgery	**Laparoscopic Surgery**	**Robotic Surgery**
Incision Size	Large incision (10–30 cm)	Small incisions (0.5–1.2 cm)	Small incisions (0.8–1.2 cm)
Visualization	Direct view of organs	Video camera provides 2D view	3D high-definition magnified view
Precision	Dependent on surgeon’s hand stability	Good precision with hand tools	High precision with robotic arms and tremor filtration
Recovery Time	Longer (weeks)	Shorter (days to weeks)	Shorter (days to weeks)
Pain & Scarring	More pain and visible scar	Less pain, minimal scarring	Less pain, minimal scarring
Cost	Generally lower	Moderate	Higher due to equipment costs
Learning Curve	Standard surgical training	Requires additional training	Requires advanced training in robotics
Hospital Stay	Longer (5–10 days)	Shorter (1–3 days)	Shorter (1–3 days)

Chapter 2: Practical Application and Theatre Experience

Before the Theatre

Consent and Patient Prep

Consent is more than just a form to be signed — it's a process of communication between the patient and the surgical team. In robotic surgery, this includes explaining that the operation will be performed using the da Vinci system, who will be operating, and what the benefits and risks are compared to open or laparoscopic approaches. The patient should understand that the robot does not operate on its own and that the surgeon is in full control at all times.

Patients are also told about any positioning that might be needed, such as steep Trendelenburg (head down) for pelvic surgery, and the potential after-effects like temporary shoulder pain from gas insufflation.

Preparation on the day includes fasting, checking allergies, marking the surgical site if applicable, and starting any prophylactic antibiotics. For students, it is worth observing how these steps are timed so that the patient is ready exactly when the theatre team needs them.

Student tip: If you are present during the consent process, pay attention to how the surgeon explains the robotic aspect. The language is often adapted for each patient, which is a good example of tailoring communication.

Fun fact: Some patients are so curious about the robot that they ask to see it before surgery — and a quick visit to the theatre can help put them at ease.

Pre-op Checks and System Start-up

Before a robotic case begins, both the patient and the system need to be checked. The anaesthetist reviews the patient's pre-operative assessment, airway, and access lines. The scrub nurse confirms that all the required robotic instruments are present, working, and within their usage limits.

The da Vinci system itself goes through a start-up sequence. This involves powering on the console and patient cart, running a self-test of the arms and joints, and ensuring the camera is functioning with a clear image. Each arm is moved briefly to confirm it responds correctly. Instruments can be attached to test recognition and movement.

For the da Vinci Xi, the team might also check that the targeting system is calibrated, which can save time during docking. For the X, positioning plans are reviewed because the system will dock from the side.

Student tip: Arrive early enough to watch the system start-up. This is one of the best times to ask about the technology because the atmosphere is calm and the team is usually happy to explain what they are doing.

Fun fact: The robot greets the team with an on-screen "welcome" message at start-up — not quite science fiction, but it does make the system feel like part of the team.

Theatre Etiquette for Students

Being in a robotic theatre is a privilege and comes with certain expectations. First and most important is maintaining sterility. Never touch the drapes, instrument tables, or the sterile parts of the robotic arms unless you are scrubbed in. Keep your hands behind your back when moving around the sterile field.

Stay aware of cables and the patient cart's arm positions — stepping on a cable or knocking an arm can interrupt the procedure. Position yourself where you can see the theatre monitor and, if allowed, the console screen.

Speak quietly and only when it will not distract the team. If you have a question during the case, direct it to someone who is not actively working at that moment, such as the anaesthetist or a circulating nurse.

At the end of the list, thank the team and the patient (if possible) for allowing you to observe. Theatre staff remember students who are polite, interested, and respectful.

Student tip: If you are unsure where to stand, ask the scrub nurse or assistant before the case starts — they will appreciate that you are thinking about safety and workflow.

Fun fact: Some experienced robotic teams can tell whether a student has been in theatre before just by how confidently they move around the room during setup.

During the Operation

What to Look for as a Student

The first few minutes after docking are where a lot of the teamwork happens. Watch how the assistant, scrub nurse, and console surgeon coordinate to get everything ready. Once the console surgeon takes control, focus on the screen — this is where you will see the inside of the patient in high definition and 3D (if you have access to a viewer).

Look for how the instruments move in relation to the target anatomy. Notice the angles, the way tissue is retracted to improve exposure, and how the camera is adjusted to follow the action. If you have been learning anatomy from textbooks or cadaveric sessions, seeing living tissue in this magnified view can help you understand relationships between structures much better.

You should also pay attention to the assistant's role. While the robot does the precision work, the assistant handles suction, clips, staplers, and specimen retrieval — all things that make the robotic part possible.

Student tip: Bring a small notebook and jot down anything that surprises you — even a short list of manoeuvres or instruments you saw. These notes will make your post-theatre reflection much easier.

Fun fact: The image on the theatre monitor is so detailed that some students say it feels like watching a high-definition nature documentary — except you are standing in the middle of it

Understanding Screen Views

In robotic surgery, the view from the camera is your window into the procedure. The console surgeon sees a 3D image, but students usually see a 2D version on the theatre monitor. Even without depth perception, you can still follow the layers of tissue, the dissection planes, and the sequence of steps.

Pay attention to how the camera is moved — it is often kept steady during delicate work and then repositioned smoothly to change the angle. The zoom is used sparingly to avoid losing context.

Look for key anatomical landmarks early in the case, because once the dissection begins, tissues can look very different. Understanding where the surgeon is working will help you follow the progress. Some theatres have a secondary screen showing an overview of the robotic arms from outside the body — this can help you link the surgeon's hand movements at the console to what you see on the main monitor.

Student tip: If you find it hard to follow the image, try mentally "anchoring" yourself to a fixed structure in the field — for example, a known blood vessel — and see how the instruments move in relation to it.

Fun fact: Some robotic systems can record the entire operation in 3D, and surgeons can review the footage later almost like a sports replay to analyse technique.

Recognising Instruments and Manoeuvres

Robotic instruments have distinctive shapes and tips, and learning to identify them makes it much easier to follow what is happening. The needle driver has jaws shaped to hold a curved needle securely. The Maryland bipolar forceps have a curved jaw with a fine tip for grasping and applying energy. Monopolar scissors have a slender blade for cutting while applying heat to seal small vessels. Vessel sealers have a broad jaw designed to grasp, seal, and divide larger structures.

You will also see manoeuvres that are specific to robotic surgery. “Wristed” movements allow the tips to rotate in ways laparoscopic tools cannot. The surgeon may use “clutching” to reposition their hands on the controls while keeping the instruments steady inside the patient. Camera swaps on the Xi system can change the perspective dramatically without moving the other arms.

Watching the assistant’s instrument changes is just as important — it is part of the choreography of the case. A smooth exchange means no delay and keeps the surgeon’s focus on the task.

Student tip: Ask for a copy of the instrument list for the case you are watching. Reading it before the operation will help you recognise each tool when it appears on the screen.

Fun fact: Some EndoWrist instruments can spin their tips endlessly in one direction — a feature that makes complex knot-tying deep inside the body much easier.

After the Operation

Safe Undocking and Closure

When the procedure is complete, the robot needs to be undocked before the final closure can take place. This is done in a careful, step-by-step way to avoid any injury to the patient or damage to the system.

First, the instruments are removed from the arms and placed on the sterile table. The camera is withdrawn so the inside of the patient is no longer in view. The arms are moved away from the ports and parked in a neutral position. On the Xi system, the overhead boom may be rotated out of the way.

The ports are then removed and any bleeding at the incision sites is dealt with immediately. The wounds are usually small, so they can be closed with sutures, skin glue, or adhesive strips. At this point, the rest of the team can approach the patient freely, as the bulky frame of the robot has been rolled away.

For students, this is a good time to observe how the theatre is returned to a safe, neutral state. It also shows the importance of reversing the setup process in an organised way.

Student tip: Pay attention to how each team member has a role in undocking — no one moves until the surgeon or assistant confirms it is safe.

Fun fact: Some experienced robotic teams can undock in under three minutes, which is about as fast as it takes to pack up a full set of camera equipment after a shoot

Post-op Care and Note

Once the patient leaves theatre, the anaesthetist and recovery team take over. They monitor the patient as they wake from anaesthesia, keeping an eye on vital signs, pain levels, and any signs of bleeding or nausea.

In robotic surgery, post-op care can often mean a quicker return to mobility compared to open surgery. Patients are encouraged to sit up, drink fluids, and even walk the same day if possible. Analgesia is tailored to the smaller incisions, which often means less reliance on strong opioids.

The surgeon or their registrar will write operative notes, which document the procedure, any unexpected findings, blood loss, complications, and post-operative instructions. These notes are vital for continuity of care and are often read by ward teams later the same day.

Student tip: If you have the chance, read the operative note after the case — it will help you link what you saw on the screen with how surgeons describe it in writing.

Fun fact: Some surgical teams attach still images from the robotic camera to the operative notes as a visual record of key steps in the procedure.

Debrief and Reflection

At the end of the case or list, many teams hold a quick debrief. This might cover what went well, any technical or workflow issues, and lessons for next time. In training centres, the debrief is also a teaching moment for trainees at the console or bedside.

For students, reflection is just as important. Think about what you saw, what you understood, and what you found confusing. Reflection doesn't have to be formal — even writing a short paragraph in a notebook can help cement your learning and make future theatre sessions more meaningful.

If something went wrong during the case, the debrief is also where the team discusses how it was handled. This is valuable to observe, because it shows the importance of communication and problem-solving under pressure.

Student tip: When reflecting, include one technical point you learned and one teamwork observation — both are equally important in surgery.

Fun fact: In some hospitals, the theatre team finishes the list with a quick group photo if it was a particularly challenging or milestone case — a small tradition that builds team spirit.

Simulation & Skills Development

Practicing on da Vinci Simulators

The da Vinci simulator is one of the best ways to develop robotic surgery skills without needing to be in theatre. The simulator can be attached to the surgeon console or run as a stand-alone unit. It recreates the exact controls, foot pedals, and vision system of the real thing.

On the screen, you work in a virtual 3D environment. The exercises range from basic hand–eye coordination tasks to full simulated surgical procedures. The system tracks your performance and scores you on speed, precision, economy of movement, and errors.

Many hospitals schedule simulator time for trainees, and some will let students try simple exercises if there's a quiet moment. Even a short session can make a big difference in understanding how the console feels to operate.

Student tip: If you get simulator time, focus on smooth movements rather than speed — the real challenge in robotic surgery is precision, not racing the clock.

Fun fact: Some simulators include mini-games like stacking virtual rings or following a moving target — skills that are surprisingly close to what you need inside a patient.

Common Exercises

Peg transfer: This is one of the classic beginner exercises. Using two robotic instruments, you pick up small objects from pegs, transfer them from one hand to the other, and place them onto different pegs. It builds dexterity and coordination between both hands.

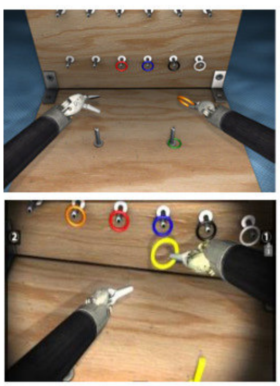
Needle driving: In this exercise, you practise passing a curved needle through marked targets, as if placing a suture. It teaches precise wrist movements and control of the needle driver.

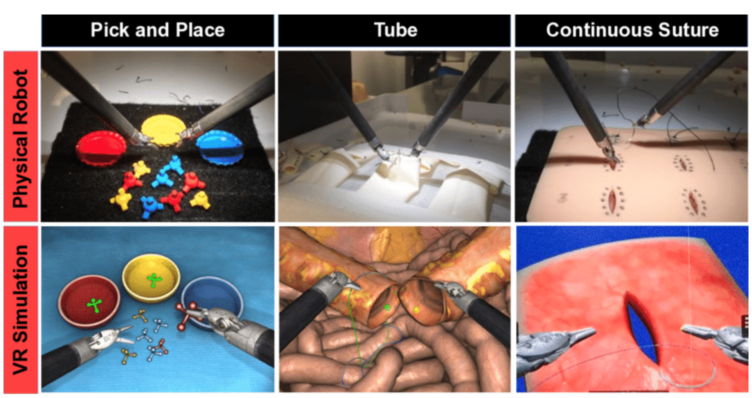
Energy dissection: This task uses instruments with monopolar or bipolar energy to dissect tissue planes in the simulator. It trains careful use of energy to avoid damaging nearby structures.

Each of these exercises can be repeated at increasing difficulty levels, adding time limits or more complex layouts.

Student tip: Keep your elbows relaxed and make small, deliberate movements — this helps you stay accurate during fine work.

Fun fact: Many surgeons still warm up with a quick peg transfer before heading into a real robotic case, even after years of experience





Chapter 3: Specialty Specific Experience at UHCW

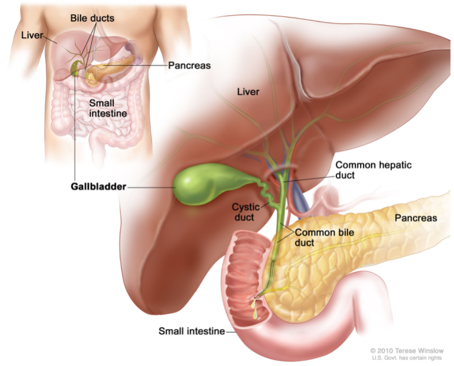
At UHCW, we take pride in being the centre of excellence in robotic surgery with multi-specialty expertise and a distinguished national and international reputation. Our Robotic Surgery Group comprises of highly experienced surgeons, including 5 proctors who have trained numerous tertiary care centres across the UK and abroad supporting them in establishing their own robotic surgery programmes.

During your visit, you may see our robotic theatres bustling with observers from across the UK, Europe and beyond, here to watch procedures performed by our renowned robotic surgery experts. Please don't feel intimidated, our operating surgeons are always happy to explain the procedure and answer your questions. If you notice the training console is free, you are welcome to ask the operating surgeon for permission to sit at the console and enjoy the immersive experience of viewing the operation from the surgeon's perspective.

Below is a brief overview of the most common robotic operations performed at UHCW. The aim is to provide a concise snapshot of the core steps involved. Remember: there is rarely only one "correct" way to perform an operation. Variations in patient positioning, port placement, and surgical steps are often based on the surgeon's preference, experience, and the specific complexity of each case.

Fun fact: Even the most seasoned robotic surgeons feel the heat when an expert is peering over their shoulder to learn the craft. So, if you see them at work, remember, they're performing under "Death Star trench run" levels of pressure

Upper GI Surgery



Robotic Cholecystectomy

Common Indication

- Symptomatic gallstones (biliary colic, cholecystitis)

Preoperative Considerations

- Review case notes, ultrasound, and any MRCP results
- Ensure liver function tests and coagulation profile are available

Patient Positioning

- Supine, legs apart (“French position”)
- Reverse Trendelenburg with left tilt to expose gallbladder

Port / Incision Placement

- 4 robotic ports (camera at umbilicus, arms in right upper quadrant and epigastrium) + 1 assistant port in right lower quadrant

Key Steps

1. Establish pneumoperitoneum, dock the robot
2. Retract gallbladder fundus cranially and infundibulum laterally
3. Dissect hepatocystic (Calot’s) triangle to clearly identify cystic duct and artery (“critical view of safety”)
4. Clip and divide cystic artery
5. Clip and divide cystic duct
6. Dissect gallbladder from liver bed using electrocautery
7. Retrieve gallbladder in an endoscopic bag and close ports

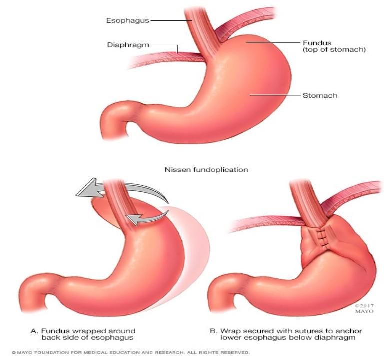
Potential Challenges / Pitfalls

- Misidentification of biliary anatomy leading to bile duct injury
- Bleeding from cystic artery or liver bed

Postoperative Considerations

- Most patients discharged same day or within 24 hours
- Monitor for: bile leak, bleeding, retained stones

Robotic Nissen Fundoplication



Common Indications

- Gastro-oesophageal reflux disease (GORD), hiatus hernia

Preoperative Considerations

- Review case notes and upper GI endoscopy report
- Check barium swallow or CT scan if available

Patient Positioning

- Supine, legs apart (“French position”)
- Reverse Trendelenburg to allow abdominal contents to fall away from the hiatus

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, working arms in right/left upper quadrants) + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock the robot
2. Retract left lobe of liver
3. Divide phreno-oesophageal ligament, identify crura
4. Mobilise oesophagus circumferentially
5. Divide short gastric vessels to mobilise fundus
6. Approximate crura with non-absorbable sutures
7. Wrap fundus 360° around distal oesophagus (2–3 cm)
8. Secure wrap with interrupted sutures
9. Check wrap, undock, close ports

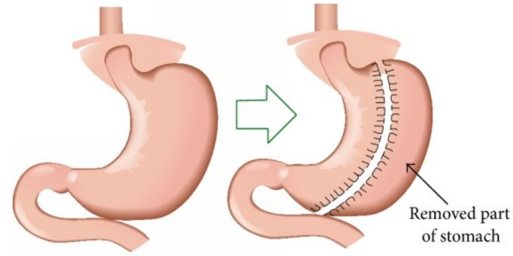
Potential Challenges / Pitfalls

- Inadequate oesophageal mobilisation (tension on wrap)
- Wrap too tight/loose → dysphagia or persistent reflux
- Splenic injury during division of short gastric vessels

Postoperative Considerations

- Fluids within 24 hours, gradual diet progression over 2–3 weeks
- Watch for: transient dysphagia, wrap migration, recurrence of reflux

Robotic Sleeve Gastrectomy



Common Indication

- Morbid obesity (BMI ⩾ 40 or ⩾ 35 with obesity-related comorbidities)

Preoperative Considerations

- Review case notes, weight loss history, and comorbidity profile
- Check upper GI endoscopy if indicated; assess nutritional status

Patient Positioning

- Supine, legs apart ("French position")
- Reverse Trendelenburg to allow gravity retraction of abdominal contents

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, working arms in left/right upper quadrants) + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock the robot
2. Retract left lobe of liver
3. Divide gastrocolic omentum along greater curvature starting 4–6 cm from pylorus
4. Mobilise greater curvature to the angle of His, dividing short gastric vessels
5. Insert bougie along lesser curvature to guide gastric sizing
6. Perform sequential stapling along bougie from antrum to fundus
7. Remove gastric remnant via specimen bag
8. Close ports and undock robot

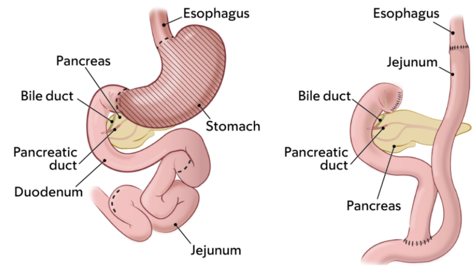
Potential Challenges / Pitfalls

- Staple line bleeding or leak
- Inadequate fundal mobilisation → residual fundus and reduced weight loss
- Splenic injury during mobilisation

Postoperative Considerations

- Clear fluids within 24 hours, progress to staged bariatric diet over weeks
- Watch for staple line leak, bleeding, strictures

Robotic Gastrectomy



Common Indication

- Gastric adenocarcinoma

Preoperative Considerations

- Review case notes, staging imaging (CT, PET, endoscopic ultrasound)
- Assess pre-op chemotherapy or previous operations

Patient Positioning

- Supine, legs apart ("French position")
- Reverse Trendelenburg to expose upper abdomen

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, working arms in right/left upper quadrants) + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock robot
2. Retract left lobe of liver
3. Mobilise greater omentum and stomach, dividing gastrocolic ligament
4. Divide short gastric vessels and mobilise fundus
5. Perform lymphadenectomy as per oncological guidelines
6. Divide duodenum and stomach (partial or total gastrectomy)
7. Create reconstruction (e.g., Billroth II, Roux-en-Y)
8. Check anastomosis integrity and haemostasis
9. Remove specimen and close ports

Potential Challenges / Pitfalls

- Splenic or pancreatic injury during mobilisation
- Inadequate lymph node clearance
- Anastomotic leak or bleeding

Postoperative Considerations

- Gradual diet progression with nutritional support
- Monitor for anastomotic leak, delayed gastric emptying, nutritional deficiencies

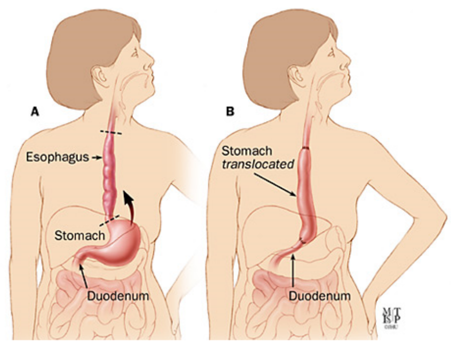
Robotic Two-Stage Ivor-Lewis Oesophagectomy

Common Indication

- Oesophageal carcinoma (mid to distal third)
- Selected cases of high-grade dysplasia or end-stage benign stricture

Preoperative Considerations

- Review case notes, staging investigations (CT, PET, endoscopic ultrasound)
- Pulmonary function tests and nutritional optimisation
- Discuss neoadjuvant therapy response if applicable



Abdominal Phase

Patient Positioning

- Supine, legs apart ("French position")
- Reverse Trendelenburg to expose upper abdomen

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, working arms in right/left upper quadrants) + 1 assistant port in left flank

Key Steps

1. Establish pneumoperitoneum, dock the robot
2. Retract left lobe of liver to expose stomach
3. Mobilise greater curvature, divide gastrocolic ligament to short gastric vessels
4. Preserve right gastroepiploic artery as main blood supply for conduit
5. Mobilise fundus, clear left gastric vessels at origin with lymphadenectomy
6. Create gastric conduit (4–5 cm width) using sequential stapling along lesser curvature
7. Ensure conduit reaches hiatus without tension
8. Perform abdominal lymphadenectomy as indicated
9. Place feeding jejunostomy (if planned)

Potential Challenges / Pitfalls

- Injury to spleen or pancreas
- Inadequate preservation of conduit blood supply
- Conduit too narrow or too wide

Thoracic Phase

Patient Positioning

- Left lateral decubitus or prone (surgeon preference, prone aids lung collapse)

Port / Incision Placement

- 4 robotic ports placed in right chest intercostal spaces + 1 assistant port
- Camera port typically at 8th intercostal space mid-axillary line

Key Steps

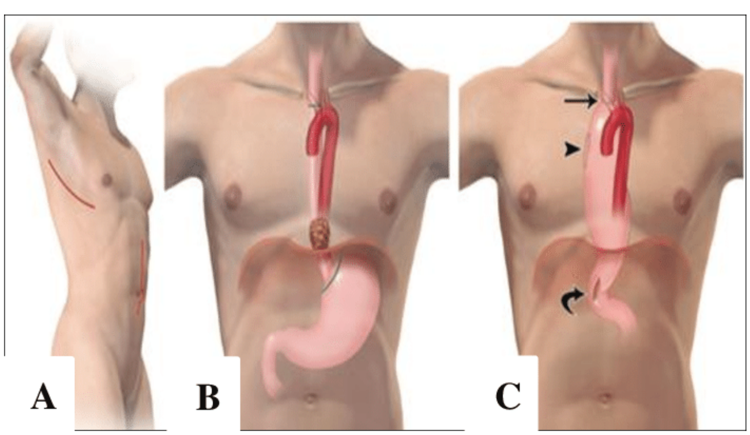
1. Enter thoracic cavity and collapse right lung (single-lung ventilation)
2. Mobilise oesophagus from diaphragm to thoracic inlet, preserving key structures
3. Identify and protect vagus nerve, thoracic duct, aorta, and airway structures
4. Perform mediastinal lymphadenectomy
5. Transect oesophagus proximally at oncologically appropriate level
6. Deliver gastric conduit through hiatus into chest
7. Perform intrathoracic oesophagogastric anastomosis (hand-sewn or stapled)
8. Place chest drains and close ports

Potential Challenges / Pitfalls

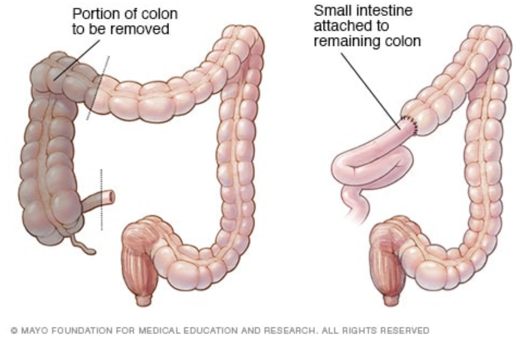
- Injury to airway, thoracic duct, or major vessels
- Anastomotic leak or stricture
- Postoperative respiratory compromise

Postoperative Considerations

- ICU/HDU monitoring for first 24–48 hours
- Early mobilisation and respiratory physiotherapy
- Gradual diet progression after swallow assessment
- Watch for anastomotic leak, chyle leak, pneumonia, conduit necrosis
-



Lower GI Surgery



Robotic Right Hemicolectomy

Common Indication

- Right-sided colon cancer

Preoperative Considerations

- Review case notes, colonoscopy, and staging imaging
- Ensure adequate bowel preparation as per protocol

Patient Positioning

- Supine, legs apart ("French position")
- Tilt left side up for exposure of right colon

Port / Incision Placement

- 5 ports: 4 robotic (camera at umbilicus, arms in lower quadrants and upper right abdomen) + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock robot
2. Medial-to-lateral mobilisation: identify ileocolic vessels
3. Divide ileocolic vessels at origin
4. Mobilise ascending colon from retroperitoneum
5. Mobilise hepatic flexure, divide gastrocolic ligament
6. Intracorporeal division of ileum and transverse colon via mini-laparotomy
7. Perform intracorporeal ileocolic anastomosis (stapled or hand-sewn)
8. Extract specimen through mini laparotomy
9. Close mini-laparotomy and ports

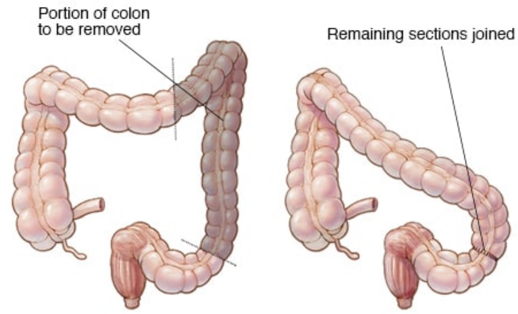
Potential Challenges / Pitfalls

- Injury to duodenum or ureter during mobilisation
- Bleeding from mesenteric vessels
- Tension on anastomosis

Postoperative Considerations

- Early oral intake as tolerated
- Monitor for: anastomotic leak, ileus

Robotic Left Hemicolectomy



Common Indication

- Left-sided colon cancer
- Diverticular disease with complications

Preoperative Considerations

- Review case notes, colonoscopy, and staging imaging
- Ensure bowel preparation per protocol

Patient Positioning

- Supine, legs apart ("French position")
- Tilt right side up for exposure of left colon

Port / Incision Placement

- 5 ports: 4 robotic (camera at umbilicus, arms in lower quadrants and upper left abdomen) + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock robot
2. Medial-to-lateral mobilisation: identify inferior mesenteric artery (IMA)
3. Divide IMA and vein near origin
4. Mobilise descending colon from retroperitoneum
5. Mobilise splenic flexure to ensure tension-free anastomosis
6. Extracorporeal division of colon and proximal rectum via mini-laparotomy
7. Stapled colourectal anastomosis
8. Return bowel, check haemostasis
9. Close mini-laparotomy and ports

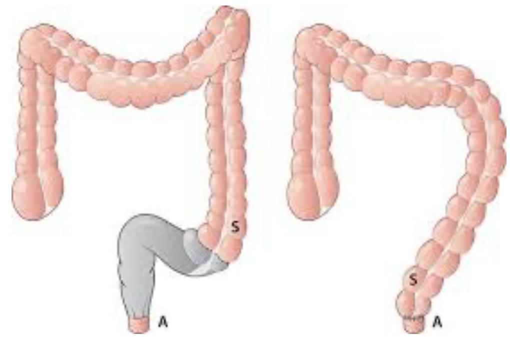
Potential Challenges / Pitfalls

- Ureter injury during medial mobilisation
- Splenic injury during flexure mobilisation
- Tension on anastomosis

Postoperative Considerations

- Early diet advancement
- Monitor for: leak, ileus

Robotic Low Anterior Resection



Common Indication

- Mid or low rectal cancer

Preoperative Considerations

- Review case notes, MRI pelvis, staging imaging
- Assess neoadjuvant therapy response if given

Patient Positioning

- Supine, legs apart in lithotomy position
- Trendelenburg with right side down for pelvic exposure

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, arms in lower quadrants and right upper abdomen) + 1 assistant port

Key Steps

- Establish pneumoperitoneum, dock robot
- Medial-to-lateral mobilisation of sigmoid colon
- Identify and protect left ureter
- Dissect and divide inferior mesenteric artery (IMA) near origin
- Dissect and divide inferior mesenteric vein (IMV)
- Mobilise descending colon and splenic flexure if needed for length
- Perform total mesorectal excision (TME) down to planned distal margin
- Transect rectum with stapler at oncologically appropriate level
- Prepare proximal colon for anastomosis
- Perform intracorporeal or extracorporeal colourectal anastomosis using circular stapler
- Test anastomosis integrity (air leak test)
- Place pelvic drain, check haemostasis, close ports

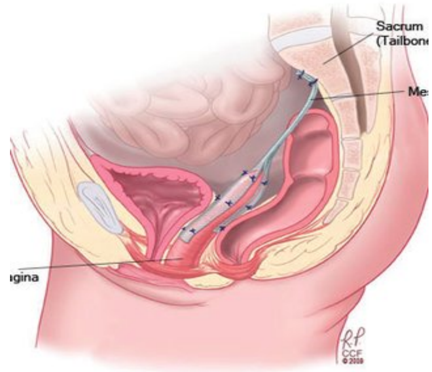
Potential Challenges / Pitfalls

- Narrow pelvis limiting instrument movement
- Injury to pelvic autonomic nerves
- Anastomotic leak

Postoperative Considerations

- Gradual return to oral intake
- Monitor for: leak, urinary or sexual dysfunction

Robotic Rectopexy



Common Indication

- Full-thickness rectal prolapse
- Selected cases of obstructed defaecation syndrome

Preoperative Considerations

- Review case notes, defaecating proctogram, and colonoscopy results
- Assess pelvic floor function

Patient Positioning

- Supine, legs apart (“French position”)
- Trendelenburg for pelvic exposure

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, arms in lower quadrants and right upper abdomen) + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock robot
2. Mobilise rectum posteriorly down to pelvic floor
3. Mobilise anterior rectum to levator ani
4. Place mesh anteriorly (ventral mesh rectopexy) or posteriorly depending on approach
5. Secure mesh to sacral promontory and rectum with sutures or tacks
6. Ensure no tension or kinking of rectum
7. Irrigate, check haemostasis
8. Close peritoneum over mesh and close ports

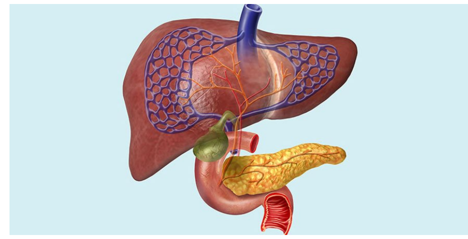
Potential Challenges / Pitfalls

- Hypogastric nerve injury causing constipation or sexual dysfunction
- Mesh infection or erosion
- Inadequate rectal mobilisation leading to recurrence

Postoperative Considerations

- Early mobilisation and gradual diet progression
- Monitor for: constipation, recurrence, mesh-related complications

Hepatobiliary and Pancreatic Surgery (HPB)



Robotic Distal Pancreatectomy with Splenectomy

Common Indication

- Malignant or benign tumours of the pancreatic body/tail
- Symptomatic cystic lesions or pancreatic neuroendocrine tumours

Preoperative Considerations

- Review case notes, CT or MRI pancreas protocol
- Ensure vaccinations for asplenia are planned if splenectomy confirmed

Patient Positioning

- Supine, legs apart ("French position")
- Reverse Trendelenburg with slight right tilt for left upper quadrant exposure

Port / Incision Placement

- 5 ports: 4 robotic (camera at umbilicus, arms in right upper/lower quadrants and left lower quadrant) + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock robot
2. Retract stomach superiorly to expose lesser sac
3. Divide gastrocolic ligament to enter lesser sac
4. Mobilise splenic flexure of colon to improve exposure
5. Identify pancreas and outline body/tail region
6. Dissect along inferior border of pancreas to expose splenic vein
7. Mobilise superior border and identify splenic artery
8. Control and divide splenic artery and vein
9. Transect pancreas with stapler at planned resection margin
10. Mobilise distal pancreas and spleen from retroperitoneum
11. Place specimen (pancreas and spleen) in retrieval bag, irrigate, check haemostasis, close ports

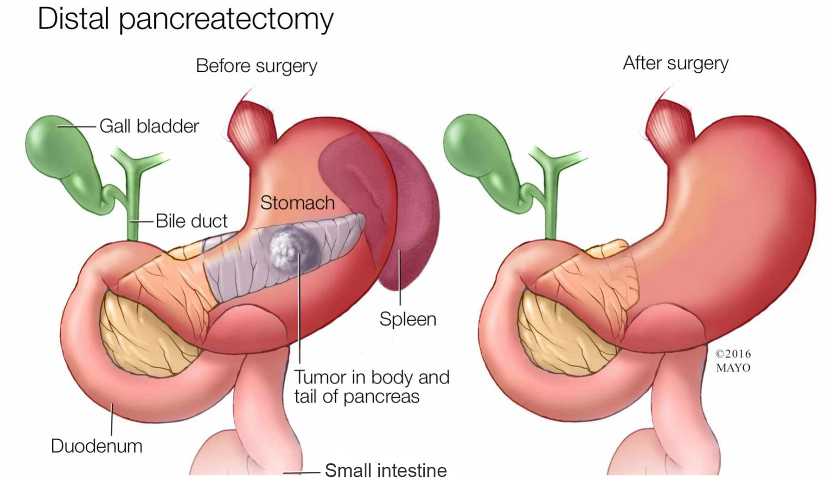
Potential Challenges / Pitfalls

- Splenic vein or artery injury causing major bleeding

- Injury to stomach or transverse colon during mobilisation

Postoperative Considerations

- Drain output monitoring for pancreatic leak
- Vaccinations for asplenia if not already given
- Watch for: bleeding, pancreatic fistula, infection



Robotic Pancreatoduodenectomy (Whipple's Procedure)

Common Indication

- Malignant tumours of the pancreatic head, ampulla, or distal bile duct
- Selected benign or premalignant periampullary lesions

Preoperative Considerations

- Review case notes, CT pancreas protocol ± MRCP
- Discuss need vascular variations for resection

Patient Positioning

- Supine, legs apart ("French position")
- Reverse Trendelenburg with slight left tilt

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, arms in upper quadrants and right lower quadrant) + 1 assistant port

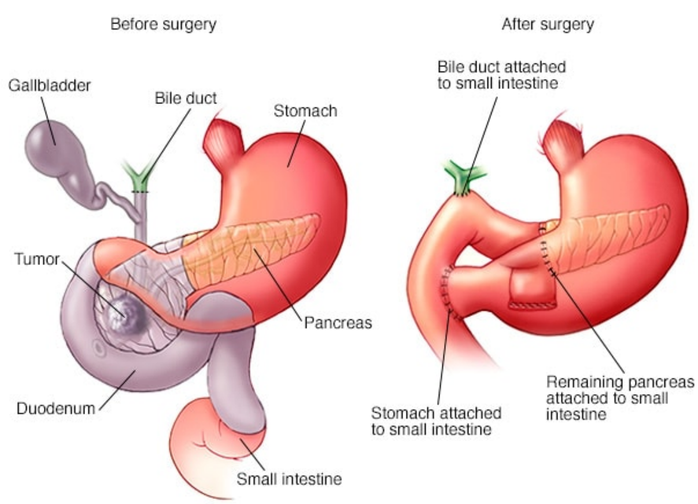
Key Steps

1. Establish pneumoperitoneum, dock robot
2. Kocher manoeuvre to mobilise duodenum and pancreatic head
3. Mobilise hepatic flexure of colon to expose duodenum and pancreas
4. Identify and dissect hepatoduodenal ligament, isolate common bile duct (CBD), hepatic artery, and portal vein
5. Divide gallbladder from liver bed
6. Divide common bile duct above cystic duct junction
7. Divide gastroduodenal artery at origin from hepatic artery
8. Mobilise stomach/duodenum, divide stomach
9. Mobilise pancreatic neck, tunnel behind it to expose SMV/portal vein
10. Divide pancreas at neck with energy device or scalpel
11. Divide proximal jejunum and mobilise to right side of SMA/SMV
12. Mobilise uncinate process from SMA/SMV
13. Remove specimen (pancreatic head, duodenum, distal bile duct, stomach)
14. Perform reconstruction:
    - Pancreaticojejunostomy
    - Hepaticojejunostomy
    - Gastrojejunostomy or duodenojejunostomy
15. Check haemostasis, place drains, close ports

Potential Challenges / Pitfalls

- Major vessel injury (portal vein, SMA)
- Unresectability

Postoperative Considerations

- ICU/HDU monitoring first 24–48 hours
- Gradual diet advancement after bowel function returns
- Monitor for: pancreatic fistula, bile leak, bleeding, delayed gastric emptying
- 

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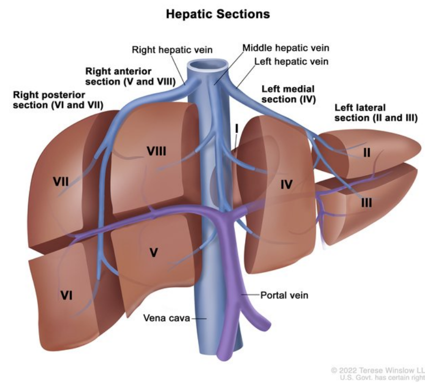
Robotic Non-anatomical Liver Resection



Common Indication

- Metastatic liver disease
- Primary liver tumours

Preoperative Considerations

- Review case notes, triphasic CT or MRI liver
- Check liver function tests and coagulation profile
- Plan resection margin based on imaging and intraoperative ultrasound

Patient Positioning

- Supine, legs apart ("French position")
- Reverse Trendelenburg with slight left or right tilt depending on lesion location

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, arms positioned to triangulate target segment) + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock robot
2. Mobilise liver lobe containing lesion (divide relevant ligaments)
3. Perform intraoperative ultrasound to confirm lesion location and resection margin
4. Control inflow if required (Pringle manoeuvre via vessel loop)
5. Begin parenchymal transection using energy device and robotic bipolar cautery
6. Identify and ligate/divide small vessels and bile ducts as encountered
7. Continue dissection to free specimen from surrounding tissue
8. Retrieve specimen in an endoscopic bag
9. Check haemostasis and bile leak test, place drain if indicated, close ports

Potential Challenges / Pitfalls

- Bleeding from hepatic veins
- Inadequate margin clearance
- Bile leak from small ducts

Postoperative Considerations

- Monitor liver function and drain output
- Watch for: bleeding, bile leak, infection

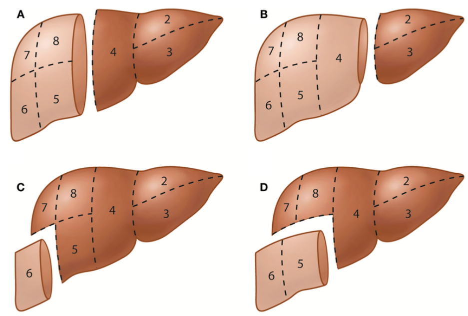
Robotic Right Hepatectomy

Common Indication

- Right-sided primary liver tumour (e.g., hepatocellular carcinoma, cholangiocarcinoma)
- Liver metastases confined to right lobe

Preoperative Considerations

- Review case notes, triphasic CT or MRI liver with volumetry
- Assess future liver remnant volume and function



Patient Positioning

- Supine, legs apart ("French position")
- Reverse Trendelenburg with slight left tilt

Port / Incision Placement

- 5 ports: 4 robotic (camera umbilical, arms in upper quadrants) + 1 assistant port

Key Steps

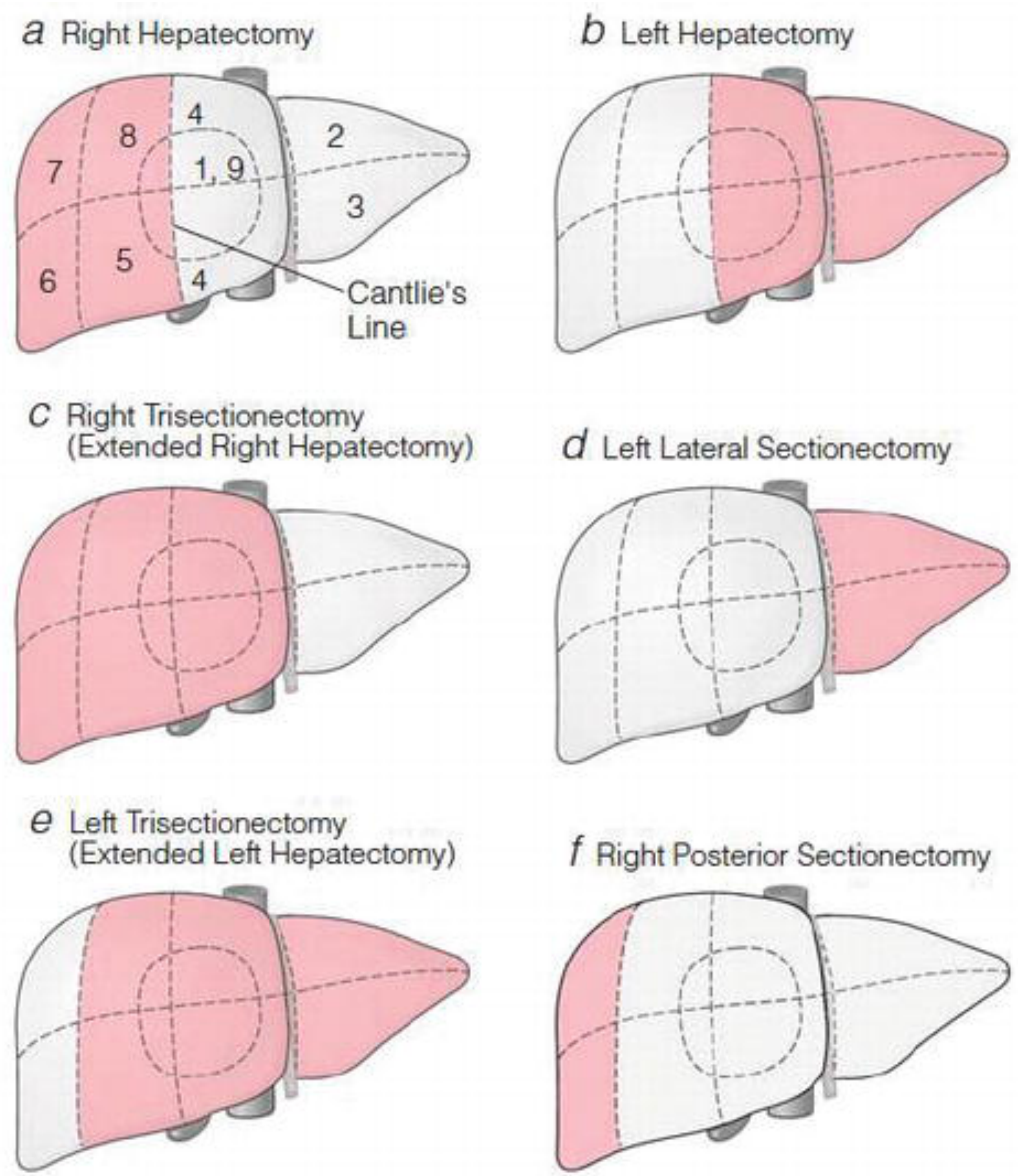
1. Establish pneumoperitoneum, dock robot
2. Mobilise right liver by dividing right coronary and triangular ligaments
3. Perform intraoperative ultrasound to confirm tumour location and vascular anatomy
4. Dissect hepatoduodenal ligament to identify right hepatic artery
5. Ligate and divide right hepatic artery
6. Identify and control right portal vein
7. Ligate and divide right portal vein
8. Demarcate line of transection on liver surface
9. Apply inflow control if needed (Pringle manoeuvre)
10. Perform parenchymal transection along demarcation line
11. Identify and divide right hepatic duct during transection
12. Complete dissection to free right liver, divide right hepatic vein
13. Retrieve specimen in an endoscopic bag, check haemostasis and bile leak, place drain, close ports

Potential Challenges / Pitfalls

- Significant bleeding from hepatic veins or IVC
- Bile leak from transection surface
- Small future liver remnant leading to postoperative liver failure

Postoperative Considerations

- Monitor liver function tests and drain output
- Watch for: bleeding, bile leak, liver failure



Robotic Bile Duct Exploration

Common Indication

- Choledocholithiasis not cleared by ERCP
- Bile duct stones found intraoperatively during cholecystectomy

Preoperative Considerations

- Review case notes, imaging (MRCP, ultrasound)
- Ensure liver function tests and coagulation profile are available

Patient Positioning

- Supine, legs apart ("French position")
- Reverse Trendelenburg with slight left tilt

Port / Incision Placement

- 4 robotic ports (camera umbilical, arms in right upper quadrant and epigastrium) + 1 assistant port

Key Steps

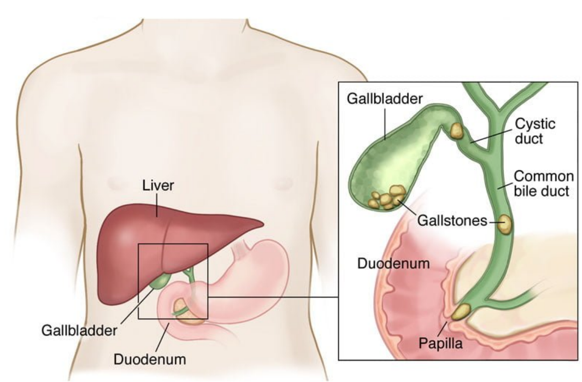
1. Establish pneumoperitoneum, dock robot
2. Retract gallbladder and expose hepatoduodenal ligament
3. Dissect Calot's triangle, identify cystic duct and common bile duct (CBD)
4. Perform cholecystectomy
5. Make longitudinal choledochotomy on anterior CBD surface
6. Introduce choledochoscope to visualise duct and locate stones
7. Extract stones using basket, balloon, or flushing
8. Close choledochotomy primarily
9. Check haemostasis and bile leak test
10. Close ports

Potential Challenges / Pitfalls

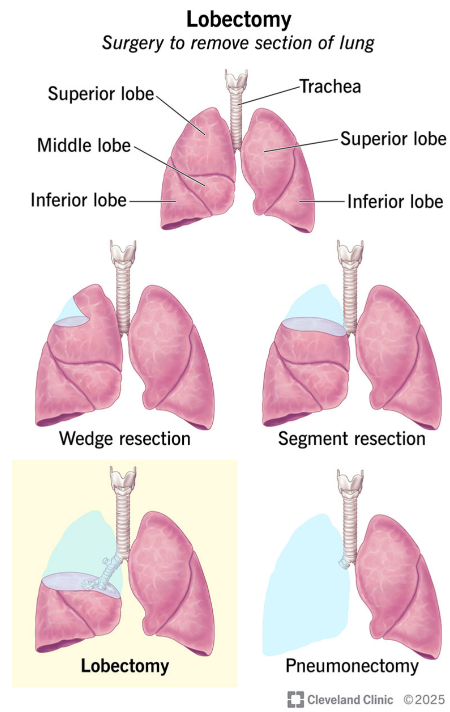
- Retained stones
- Bile leak

Postoperative Considerations

- bile leak, bleeding



Gallstones



Thoracic Surgery

Robotic Lobectomy

Common Indication

- Early-stage non-small cell lung cancer (NSCLC)
- Selected benign lesions not amenable to wedge resection

Preoperative Considerations

- Review case notes, CT chest ± PET-CT
- Pulmonary function tests and cardiology review if indicated

Patient Positioning

- Lateral decubitus with operative side up
- Table flexed to widen intercostal spaces

Port / Incision Placement

- 3-4 robotic ports along a single intercostal space (camera mid-axillary) + 1 assistant port anteriorly

Key Steps

1. Dock robot and enter pleural cavity
2. Divide pulmonary ligament if needed for exposure
3. Isolate and divide pulmonary vein for target lobe
4. Isolate and divide pulmonary artery branches to target lobe
5. Perform hilar lymphadenectomy as required
6. Divide bronchus to target lobe after ensuring adequate ventilation of remaining lobes
7. Complete fissure division (fissure-last or fissure-first depending on anatomy)
8. Retrieve specimen in endoscopic bag
9. Check haemostasis and air leak
10. place chest drain, close ports

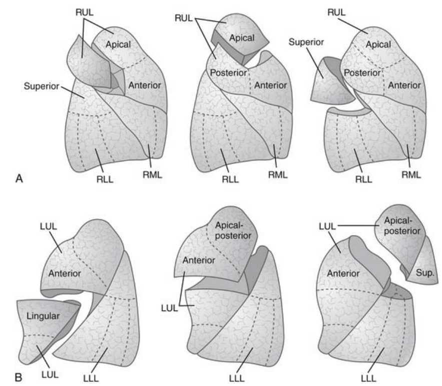
Potential Challenges / Pitfalls

- Bleeding from pulmonary vessels

- Incomplete lymph node clearance
- Prolonged air leak

Postoperative Considerations

- Monitor chest drain output and air leak
- Early mobilisation and breathing exercises



Robotic Segmentectomy

Common Indication

- Small, peripheral NSCLC where lung preservation is desirable
- Benign lesions requiring anatomical resection

Preoperative Considerations

- Review case notes, high-resolution CT with 3D reconstruction if available
- Pulmonary function tests for operative fitness

Patient Positioning

- Lateral decubitus with operative side up
- Table flexion to improve rib spacing

Port / Incision Placement

- 3-4 robotic ports (camera mid-axillary, working ports anterior/posterior) + 1 assistant port

Key Steps

1. Dock robot and inspect pleural cavity
2. Identify and dissect segmental pulmonary vein
3. Identify and divide segmental pulmonary artery branch
4. Dissect and divide segmental bronchus after confirming inflation/deflation line
5. Perform lymph node dissection in relevant stations
6. Inflate lung to identify intersegmental plane, mark with cautery
7. Divide parenchyma along intersegmental plane with staplers or energy device
8. Retrieve specimen, check for air leak, place drain, close ports

Potential Challenges / Pitfalls

- Misidentifying vascular or bronchial anatomy
- Prolonged air leak from stapling along fissureless segments

Postoperative Considerations

- Monitor for air leak, early mobilisation
- Histology confirmation to ensure clear margins

Robotic Wedge Resection

Common Indication

- Diagnostic excision of pulmonary nodule
- Small benign or metastatic lesion

Preoperative Considerations

- Review case notes, CT scan ± PET-CT
- Pulmonary function assessment if larger resection possible

Patient Positioning

- Lateral decubitus with operative side up

Port / Incision Placement

- 3–4 robotic ports (camera mid-axillary) + optional assistant port

Key Steps

1. Dock robot and inspect pleural cavity
2. Identify target lesion by visualisation or palpation with instruments
3. Mobilise surrounding lung tissue to improve access
4. Place staplers to encompass lesion with adequate margins
5. Remove specimen in retrieval bag
6. Check for air leak under saline and inflation
7. Place drain if required, close ports

Potential Challenges / Pitfalls

- Difficulty locating small/deep nodules without pre-op marking
- Inadequate resection margins requiring conversion to segmentectomy

Postoperative Considerations

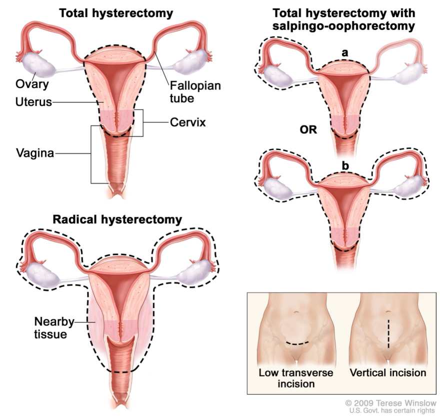
- Early discharge possible if no air leak
- Monitor for pneumothorax or bleeding

Gynaecology

Robotic Total Hysterectomy with Bilateral Salpingo-Oophorectomy

Common Indication

- Endometrial carcinoma, Benign uterine disease



Preoperative Considerations

- Review case notes, pelvic ultrasound or MRI
- Check cervical smear history and endometrial biopsy results

Patient Positioning

- Lithotomy with steep Trendelenburg
- Arms tucked, pressure points padded

Port / Incision Placement

- 4 robotic ports across lower abdomen + 1 assistant port lateral to umbilicus

Key Steps

1. Establish pneumoperitoneum and dock robot
2. Survey pelvis and upper abdomen for unexpected pathology
3. Coagulate and divide round ligaments bilaterally
4. Open broad ligaments and identify ureters
5. Coagulate and divide infundibulopelvic ligaments to remove adnexa
6. Skeletonise and divide uterine vessels
7. Circumferentially detach vagina around cervix
8. Remove uterus and adnexa vaginally or via specimen bag
9. Close vaginal cuff robotically

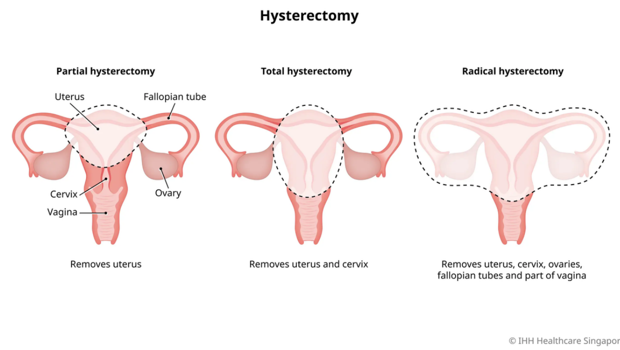
Potential Challenges / Pitfalls

- Ureter injury during vessel division
- Bleeding from uterine pedicles

Postoperative Considerations

- Early mobilisation, light diet

- Monitor for bleeding or vault infection



Robotic Radical Hysterectomy

Common Indication

- FIGO stage IA2–IB1 cervical carcinoma

Preoperative Considerations

- Review MRI pelvis for parametrial involvement
- Cystoscopy or proctoscopy if suspicion of local invasion

Patient Positioning

- Low lithotomy in steep Trendelenburg
- Careful padding to prevent nerve injuries

Port / Incision Placement

- 4 robotic ports in a fan-shaped configuration + 1 assistant port

Key Steps

1. Establish pneumoperitoneum, dock robot
2. Inspect abdomen and pelvis for metastatic disease
3. Develop paravesical and pararectal spaces
4. Mobilise bladder off cervix and anterior vagina
5. Mobilise rectum from posterior vagina
6. Identify and protect ureters throughout
7. Divide uterine arteries at origin from internal iliac
8. Resect parametrial tissue en bloc with uterus
9. Resect upper 1–2 cm of vagina with specimen
10. Bilateral pelvic lymphadenectomy
11. Remove specimen vaginally or in bag via port
12. Close vaginal cuff robotically

Potential Challenges / Pitfalls

- Ureteric devascularisation or injury
- Bleeding from internal iliac branches
- Lymphocyst formation post-lymphadenectomy

Postoperative Considerations

- Prolonged catheter drainage if bladder function impaired
- Monitor for DVT/PE and wound infection

Robotic Ovarian Tumour Resection / Oophorectomy

Common Indication

- Benign or borderline ovarian tumours not suitable for cystectomy
- Removal of adnexa in postmenopausal women with suspicious mass

Preoperative Considerations

- Review ultrasound or MRI, CA-125 level

- Ensure surgical plan accounts for possibility of malignancy

Patient Positioning

- Lithotomy with moderate Trendelenburg

Port / Incision Placement

- 3–4 robotic ports + 1 assistant port positioned to allow lateral pelvic access

Key Steps

1. Establish pneumoperitoneum and dock robot
2. Inspect pelvis and abdomen for disease spread
3. Mobilise adnexa by dividing adhesions if present
4. Identify and protect ureter on affected side
5. Coagulate and divide infundibulopelvic ligament
6. Coagulate and divide utero-ovarian ligament (if uterus preserved)
7. Place specimen in retrieval bag and remove intact
8. Irrigate pelvis, check haemostasis, close ports

Potential Challenges / Pitfalls

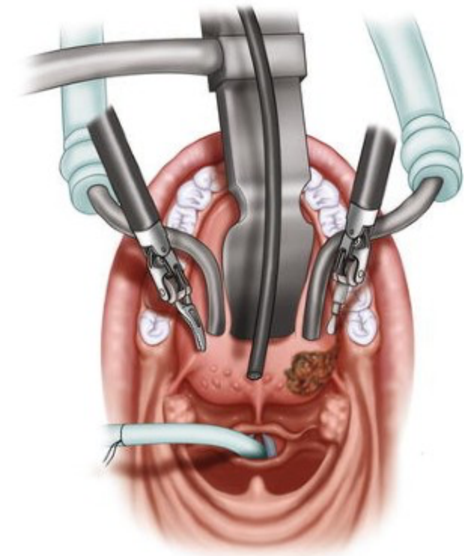
- Spillage of cyst contents
- Injury to ureter or pelvic vessels

Postoperative Considerations

- Early discharge in benign cases
- Histology review to confirm diagnosis and guide follow-up

ENT Surgery

Transoral Robotic Surgery (TORS) for Oropharyngeal Tumours



Common Indication

- Tonsillar carcinoma
- Base of tongue carcinoma

Preoperative Considerations

- Review case notes, MRI/CT neck ± PET-CT

Patient Positioning

- Supine with shoulder roll, neck extended
- Mouth gag and retractor to expose oropharynx

Port / Instrument Placement

- Robotic camera and two working arms placed transorally via retractor system

Key Steps

1. Insert mouth gag and position retractor for exposure
2. Dock robot with camera and working arms through retractor
3. Inspect surgical field and confirm tumour margins
4. Infiltrate local anaesthetic with adrenaline for haemostasis
5. Incise mucosa around planned margin using monopolar cautery or laser
6. Dissect through submucosa, preserving vital neurovascular structures
7. Mobilise tumour from deep muscle planes
8. Continue circumferential dissection until tumour is free
9. Remove specimen en-bloc, place in retrieval pouch
10. Achieve haemostasis using bipolar cautery
11. Remove robotic instruments and retractor, check airway patency

Potential Challenges / Pitfalls

- Limited exposure in patients with small jaw opening
- Bleeding from lingual or tonsillar branches of facial artery

Postoperative Considerations

- Close airway monitoring; some patients may need temporary tracheostomy
- Early swallow assessment to guide diet

Transoral Robotic Surgery (TORS) for Supraglottic Laryngectomy

Common Indication

- Selected T1–T2 supraglottic laryngeal carcinoma
- Selected benign supraglottic lesions causing obstruction

Preoperative Considerations

- Review case notes, CT/MRI larynx and neck
- Airway plan with anaesthetist; discuss potential for tracheostomy

Patient Positioning

- Supine with shoulder roll, neck extended
- Mouth retractor positioned to expose supraglottis and glottis

Port / Instrument Placement

- Robotic camera and two working arms introduced via retractor system

Key Steps

1. Insert retractor and optimise view of supraglottis
2. Dock robotic system with camera and working instruments
3. Identify epiglottis, aryepiglottic folds, and tumour margins
4. Infiltrate local anaesthetic with adrenaline for haemostasis
5. Incise mucosa and divide aryepiglottic folds bilaterally
6. Resect false vocal cords and pre-epiglottic space en bloc with tumour
7. Preserve vocal cords and arytenoids where oncologically safe
8. Achieve haemostasis with bipolar cautery
9. Remove specimen, undock robot, and check airway

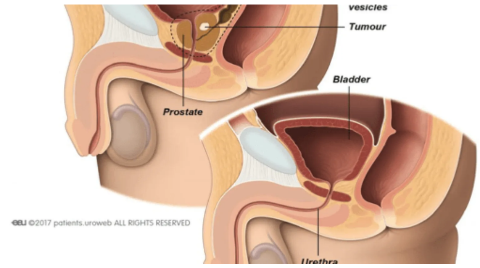
Potential Challenges / Pitfalls

- Airway compromise from postoperative swelling
- Bleeding from superior laryngeal artery branches

Postoperative Considerations

- Close airway observation; tracheostomy in selected cases
- Early swallow therapy to prevent aspiration

Urological Surgery



Robotic-Assisted Radical Prostatectomy (RARP)

Common Indication

- Localised prostate cancer (T1–T2)
- Selected T3 disease without nodal or metastatic spread

Preoperative Considerations

- Review MRI prostate, biopsy results, and PSA trend
- Discuss continence and erectile function implications with patient

Patient Positioning

- Supine, steep Trendelenburg
- Legs apart in stirrups, arms tucked

Port / Incision Placement

- 6 ports: 4 robotic (camera midline infra-umbilical, arms lateral), 1 assistant port, 1 optional suction port

Key Steps

1. Establish pneumoperitoneum, dock robot
2. Drop bladder and expose prostate via anterior peritoneotomy
3. Control dorsal venous complex
4. Incise endopelvic fascia bilaterally
5. Identify bladder neck, divide and preserve mucosal margins
6. Mobilise seminal vesicles and vasa deferens
7. Control prostatic pedicles with clips or bipolar energy
8. Nerve-sparing dissection if indicated
9. Divide urethra at apex, preserving sphincter
10. Retrieve prostate in specimen bag
11. Perform vesicourethral anastomosis with continuous sutures
12. Check watertight anastomosis, place catheter, close ports

Potential Challenges / Pitfalls

- Bleeding from dorsal venous complex
- Urethral shortening compromising anastomosis

Postoperative Considerations

- Catheter usually removed at 1–2 weeks
- Monitor continence, PSA at follow-up

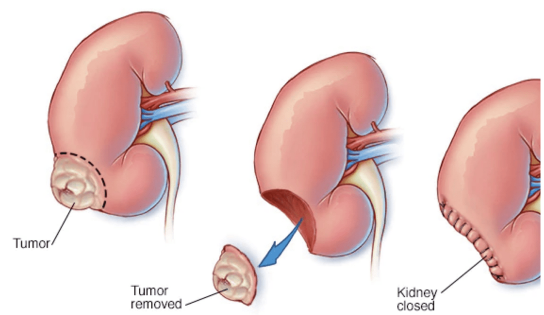
Robotic Partial Nephrectomy

Common Indication

- Small renal mass (T1a/T1b) amenable to nephron-sparing surgery

Preoperative Considerations

- Review CT or MRI kidney with 3D reconstruction



Patient Positioning

- Modified flank position, operative side up
- Table flexion to widen rib space

Port / Incision Placement

- 4 robotic ports in a curvilinear arrangement + 1 assistant port

Key Steps

1. Dock robot, mobilise colon to expose kidney
2. Identify renal hilum, dissect artery and vein
3. Intraoperative ultrasound to localise tumour and define margins
4. Mark resection line on kidney surface
5. Apply vascular clamp to renal artery (± vein)
6. Excise tumour with cold scissors, maintaining safe margin
7. Control bleeding points in resection bed
8. Close collecting system if entered
9. Reconstruct renal parenchyma in two layers (renorrhaphy)
10. Remove clamps, ensure haemostasis, close ports

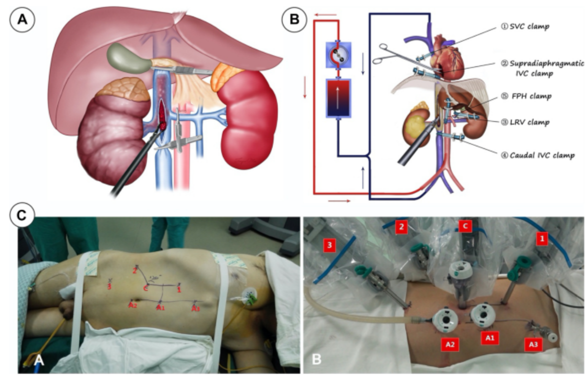
Potential Challenges / Pitfalls

- Prolonged warm ischaemia time
- Bleeding from segmental vessels
- Urine leak from collecting system

Postoperative Considerations

- Monitor renal function and drain output
- Early mobilisation

Robotic Radical Nephrectomy



Common Indication

- Large or centrally located renal tumour

Preoperative Considerations

- Review imaging for renal vein or IVC involvement
- Baseline renal function, crossmatch blood if large tumour

Patient Positioning

- Modified flank position, operative side up

Port / Incision Placement

- 4 robotic ports + 1 assistant port in a linear or curvilinear arrangement

Key Steps

1. Dock robot, mobilise colon for retroperitoneal exposure
2. Dissect and control renal artery
3. Dissect and control renal vein (± gonadal and adrenal veins)
4. Mobilise kidney from surrounding fat and fascia
5. Control and divide ureter
6. Free upper pole, dividing adrenal gland if indicated
7. Place kidney in retrieval bag and remove via mini-laparotomy
8. Check haemostasis, close ports

Potential Challenges / Pitfalls

- Bleeding from renal hilum
- Injury to IVC or adrenal gland

Postoperative Considerations

- Monitor haemoglobin and renal function
- Early mobilisation, analgesia

Robotic Radical Cystectomy with Intracorporeal Urinary Diversion

Common Indication

- Muscle-invasive bladder cancer
- High-risk recurrent non-muscle invasive bladder cancer

Preoperative Considerations

- Review imaging for extravesical spread or nodal disease
- Discuss urinary diversion options with patient

Patient Positioning

- Supine, steep Trendelenburg, legs apart

Port / Incision Placement

- 6 ports: 4 robotic (camera infra-umbilical, arms lateral), 1 assistant, 1 retraction port

Key Steps

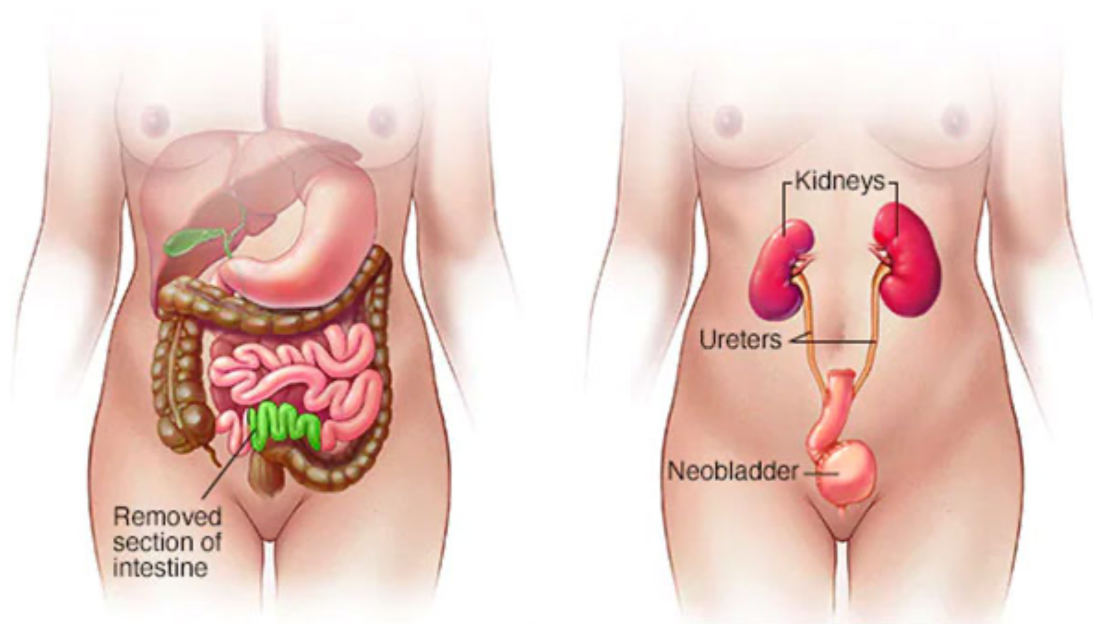
1. Dock robot, drop bladder, and expose pelvic sidewalls
2. Identify and control ureters bilaterally, clip distally
3. Mobilise bladder from pelvic floor
4. Control dorsal venous complex
5. Mobilise prostate and seminal vesicles (male) or uterus/adnexa (female)
6. Divide urethra with margin for frozen section
7. Perform extended pelvic lymphadenectomy
8. Retrieve bladder specimen in bag
9. Select bowel segment for diversion (ileal conduit or neobladder)
10. Isolate bowel segment with staplers
11. Restore bowel continuity with stapled anastomosis
12. Fashion urinary reservoir or conduit intracorporeally
13. Implant ureters into diversion, ensuring watertight anastomosis
14. Place stents, drains, and confirm haemostasis
15. Close ports

Potential Challenges / Pitfalls

- Prolonged operative time
- Leak from ureteroenteric anastomosis
- Bowel injury

Postoperative Considerations

- Monitor urostomy for neobladder function
- Thromboprophylaxis and nutritional support



Robotic Pyeloplasty

Common Indication

- Ureteropelvic junction (UPJ) obstruction causing hydronephrosis

Preoperative Considerations

- Review imaging (MAG3 renogram, CT urography)

Patient Positioning

- Modified flank position, operative side up

Port / Incision Placement

- 3–4 robotic ports + 1 assistant port

Key Steps

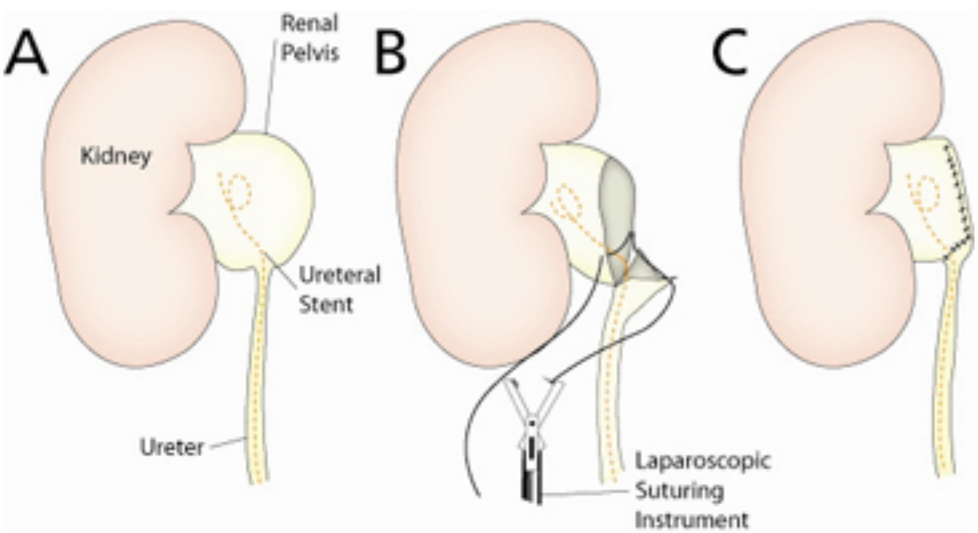
1. Dock robot, mobilise colon to expose kidney and UPJ
2. Identify renal pelvis and proximal ureter
3. Mobilise ureter and excise narrowed UPJ segment
4. Spatulate ureter to widen lumen
5. Bring ureter to renal pelvis without tension
6. Perform posterior layer of anastomosis with continuous sutures
7. Insert double-J stent
8. Complete anterior layer of anastomosis
9. Check watertight seal, close ports

Potential Challenges / Pitfalls

- Tension on anastomosis causing leak or stricture
- Injury to renal vessels

Postoperative Considerations

- Stent removed at 4–6 weeks
- Monitor renal drainage on follow-up scan



Chapter 4: Future, Reflections & Careers

The Future of Robotic Surgery

When it comes to the future, it's hard not to get a little excited about where robotics is heading. Artificial intelligence is no longer the stuff of science fiction, we are already seeing algorithms that can recognise anatomy on the screen and suggest safe dissection planes, almost like having a wise mentor whispering in your ear. Automation is creeping in as well, don't picture robots operating on their own just yet, but imagine the machine tying a perfect knot or suturing with millimetre precision while you focus on the bigger picture. Then there's single-port robotic surgery, where the whole operation happens through a single, small incision, brilliant for cosmesis and potentially recovery, but it does change the way surgeons work and train. And perhaps the most intriguing of all is telesurgery the idea that an expert could operate from the other side of the world. The technology exists, but until we have ultra-reliable, lag-free connections, it will stay more of a tantalising glimpse of what's possible than a daily reality.

It's no longer just the da Vinci in the robotic theatre, there's a whole new generation of systems quietly lining up, each hoping to earn a place on the surgical stage. Versius, developed here in the UK by CMR Surgical, is compact, modular, and designed to fit into theatres without needing major rebuilds, think of it as the nimble, flexible newcomer. Hugo from Medtronic is making a splash with its open-console design and portable arms that can be wheeled in and out as needed. Over in Japan, the Hinotori system brings a sleek, ergonomic style with a focus on comfort for long operating sessions. And we can't ignore the rapidly growing number of Chinese entrants, like the MicroPort Toumai and others bringing competitive pricing and aggressive development cycles. More players in the market doesn't just mean different buttons to press, it means genuine competition, driving innovation, pushing down costs, and ultimately making robotic surgery more accessible around the world.

Ethics, Cost and Accessibility

Robotic surgery in the NHS sits in a tricky sweet spot between innovation and affordability. These systems aren't cheap (£1.5-2 million) the initial purchase is only the beginning, with yearly maintenance contracts (£150-200K pa) and instrument costs that can make finance managers wince (each instrument between £150-400). The challenge is making sure the benefits like shorter hospital stays, less blood loss, faster recovery are balanced against the price tag. Health equity is a big part of this conversation. It's all too easy for robotic surgery to become a postcode lottery, where some patients in major centres get access to the latest kit while others, just a few miles away, don't have the option at all. Funding decisions need to be guided by evidence not postcode or prestige so that the technology genuinely serves patients across the whole country not just those living near a flagship hospital.

Patient safety, litigation and learning curve

While the technology is impressive, patient safety is still built on the same foundation as any surgery ie skill, preparation, and good judgement. Robotic surgery has its own learning curve and it's not something you "pick up" in a weekend course. Surgeons need structured training, simulation, proctoring, and a gradual increase in case complexity before they fly solo at the console. Patients deserve to know where their surgeon is on that journey, and what that means for their care. On the legal side, robotics adds a new layer to litigation: if something goes wrong, is it the surgeon, the hospital, or the manufacturer at fault? Clear protocols, open communication, and transparency with outcomes are key, not just for protecting patients, but for building the trust that lets this technology flourish.

How to Get Involved as a Student

You don't need a consultant badge or years of theatre experience to dip your toe into the world of robotic surgery. In fact, medical school is the perfect time to start. Academic projects are a great entry point – these might be retrospective studies comparing robotic and laparoscopic outcomes, audits of theatre efficiency, or even systematic reviews of emerging techniques. Quality Improvement Projects (QIPs) are another route, especially if you spot something in the theatre process that could be smoother, whether that's improving consent forms or reducing set-up time for the robot.

Many universities now have student-led robotic surgery societies, often linked with surgical societies or national networks. They can open doors to simulator sessions, hands-on workshops, and mentorship from trainees and consultants who live and breathe this field.

If you're serious about a career in robotics, look at specialties where the technology is already well established eg urology, colourectal, gynaecology, cardiothoracics, and hepatobiliary surgery. Build your CV with relevant research, seek out rotations at centres with robotic programmes and learn the basics of open and laparoscopic surgery first. The robot is an incredible tool, but it's not a shortcut, the best robotic surgeons are those with strong fundamentals and sharp judgement.

Final thoughts

Robotic surgery is not just about steel arms, 3D cameras, and glowing consoles, it’s about people. People who believe that technology can help us operate more precisely, recover patients more quickly, and push the boundaries of what’s possible. As a student, you are entering medicine at a time when the surgical world is changing faster than ever before. Whether you end up at the console, leading research, or simply understanding the capabilities and limitations of these systems, you will be part of the story. Stay curious, ask questions, and never forget that behind every innovation is a patient who trusts us to get it right. The future is in your hands – and maybe, one day, also in the hands of a robot you control.