National University
Heart Centre
Singapore

Thoracic Surgery: Patient Information Brochure

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NUHCS Thoracic Surgery

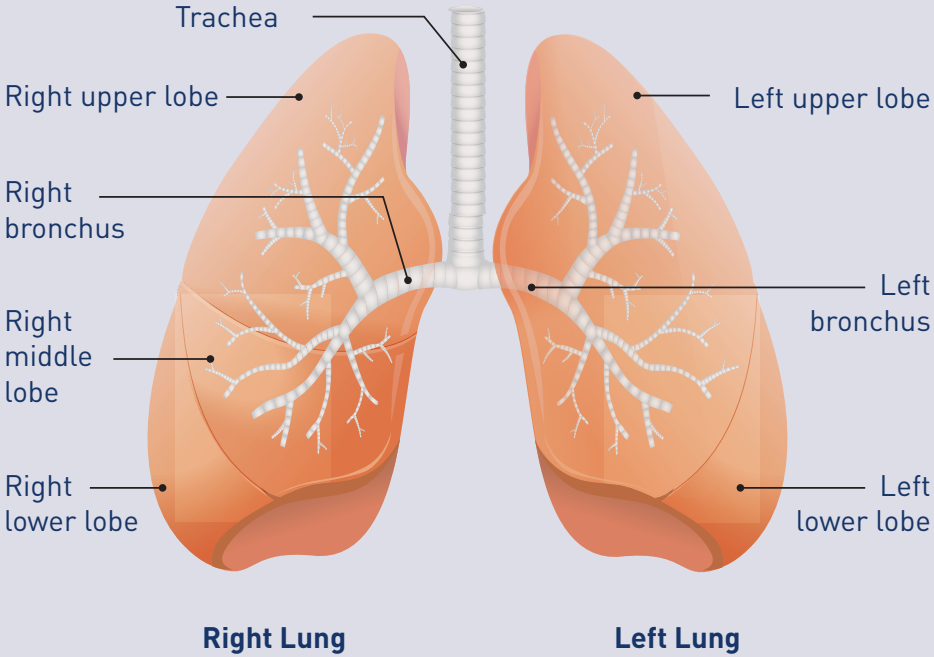
Established in 2007, the NUHCS Lung Surgery Team today carries out more than 400 lung surgeries each year. In 2009, NUHCS is the first centre in Singapore to carry out the Uniportal Video-Assisted Thoracic Surgery (UVATS) - where lung surgery is performed with only a single cut of about 3cm at the side of the chest - and is the only centre in Singapore with a full team of experienced UVATS thoracic surgeons supported by a team of specialty care nurses and case managers. In addition to the wide range of lung conditions, the centre also manages rarer conditions such as Hyperhidrosis (excessive sweating), Pectus Chests (pigeon or funnel chests), and Rib Fractures.

NUHCS Thoracic Surgery Team

What is Thoracic Surgery?

Thoracic Surgery is surgery performed to treat various parts of your chest including the lungs, diaphragm, chest wall and mediastinum. Our surgeons are trained to do both minimally invasive and open surgeries depending on your needs.

Anatomy of the Lung



Everyone has two lungs, a right and left lung. These lungs are divided into lobes, three on the right and two on the left. The lobes on the right are called the upper, middle and lower lobes. The lobes on the left are called the upper and lower lobes. Within each lobe they are also further divided into segments. Each segment has its own blood and air supply.

The lungs exist in your chest and are wrapped by two thin layers called pleura. The pleura overlying your lung is called the visceral pleura, the pleura attached to the chest wall is called the parietal pleura. Between these two pleura there is pleural fluid, a lubricant that helps your lung move within your chest.

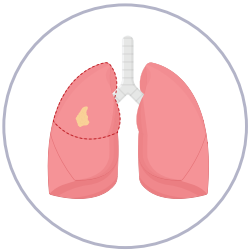
Both lungs are connected to your nose and mouth via your windpipe. Your windpipe starts off as the trachea in your neck and as it goes down towards your lungs, divides into bronchus. These carry air from outside your body into your lungs for oxygen to be absorbed and carbon dioxide to be released.

Like all organs in your body, there are lymph nodes within and around the lung. These are mainly distributed along the bronchus.

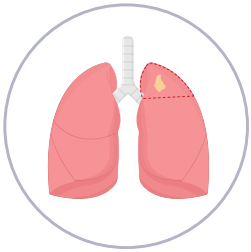
Your lungs lie in close relation to your heart and the space between the lungs are called the mediastinum. It is for this reason thoracic surgery has its specific risks as our surgeons operate close to your vital organs.

Surgery Planned

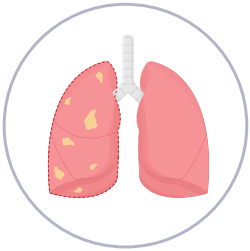
Depending on the location of your lung lesion, the surgeon would recommend an appropriate surgery to cleanly remove the lesion and ensure no cancer cells get left behind. To do this, they must not only take the lesion but a sufficient part of the lung either along the divisions (lobes and segments) or with a wedge resection. In general, the different types of surgeries can be found on page 7.



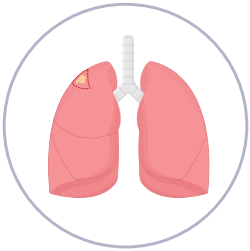
Lobectomy
Removal of the entire lobe of that lung (upper, middle or lower) with its accompanying arteries, veins and bronchus.



Segmentectomy
Removal of the entire segment of that lung with its accompanying arteries, veins and bronchus.



Pneumonectomy
Removal of one side of the entire lung (right or left) with its accompanying arteries, veins and bronchus.



Wedge Resection
Removal of a part of the lung **without** the arteries, veins and bronchus.

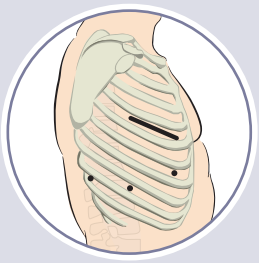
Scan this QR code to learn more about lung surgery at NUHCS

In addition to removing the lung, if there is suspicion of cancer, your surgeon will remove the surrounding lymph nodes to check for cancer spread to these areas. This will help remove early spread of cancer cells to these lymph nodes and help the surgeon accurately stage the cancer.

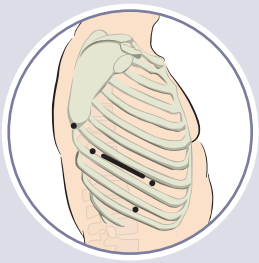
How is the Surgery Performed?

Lung surgery is performed under general anaesthesia and there are many approaches possible. Your surgeon will discuss with you the optimal approach to facilitate the safe removal of the disease. Here are some common methods of performing lung surgery.

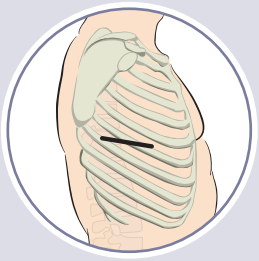
Uniportal VATS (UVATS)
Minimal invasive surgery that involves accessing the lungs through a single 3cm incision.



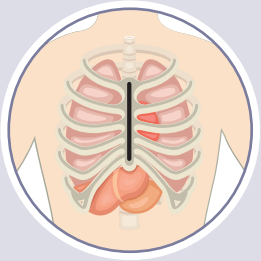
Video Assisted Thoracoscopic Surgery (VATS)
Keyhole surgery using a telescopic camera to perform the surgery via smaller incisions to facilitate recovery and minimize pain.



Robotic Assisted Thoracoscopic Surgery (RATS)
Keyhole surgery using the aid of a robot to perform the surgery via smaller incisions to facilitate recovery and minimize pain.



Open Thoracotomy
A conventional incision about 15cm long along your side and towards the shoulder plate to reach the lungs.



Median Sternotomy
Splitting of the breast bone to reach the heart and lungs.

What are the Risks of Surgery?

Your surgeon will advise on the potential risks of surgery specific to you. In general, here are some of the common risks:

- ☐ General anaesthesia risks including stroke, heart attack and death
- ☐ Bleeding requiring conversion
- ☐ Infection requiring wound dressings
- ☐ Air leak requiring discharge with chest drain
- ☐ Pain
- ☐ Atrial fibrillation
- ☐ Phrenic nerve injury causing diaphragmatic paralysis
- ☐ Injury to heart and major vessels
- ☐ Reoperation
- ☐ _____
- ☐ _____

Ok, I'm agreeable for surgery, what's next?

In order to safely perform the surgery, your surgeon will arrange necessary tests for you prior to the surgery. This may include blood tests, additional scans, heart and lung tests to ensure that you are fit to undergo surgery. You will also be seeing the anaesthetist prior to the surgery to better understand the anaesthesia plan for that day. They will also advise on the necessary medications to omit prior to surgery.

You will be contacted one working day prior to the surgery date to receive final instructions on what time and where to report. For most cases, you are allowed to admit on the morning of the surgery so you can get a good night's rest at home the day before.

In the lead up to surgery, you are advised to continue exercising to build your stamina and eat more to increase your body's nutrients. Please do not take traditional medications before and after surgery as they will often lead to unexpected complications such as bleeding.

Surgery Day

It is normal to feel nervous on your surgery day. You will be brought to the operating theatre and the team will check on you multiple times before administering anaesthesia. You will not be aware or feel any pain once you are under general anaesthesia.

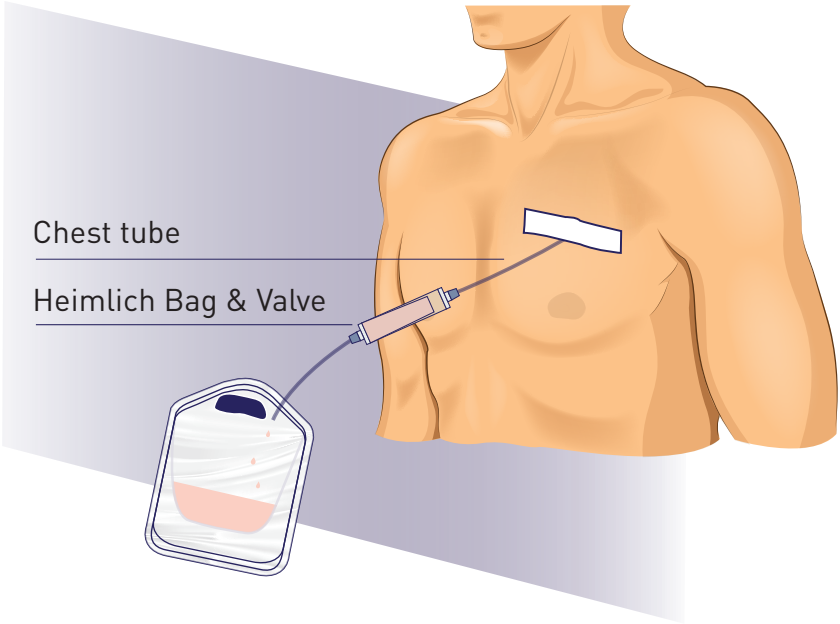
When you wake up, it is normal to feel tired and drowsy. You will likely be in the recovery area (Post-Anaesthesia Care Unit) for observation before being brought to the ward. If you are in pain, please tell us so that we can help you with it. It is advisable to prop yourself up at least 35-40 degrees to assist with breathing and to cough up phlegm, if any, to facilitate recovery.

Post-Operative Care

On the first Post Operative Day (POD), a physiotherapist will be assisting you with mobilization and deep breathing exercises.

There will be a chest drain coming out from you to drain the remaining fluid and air within your chest. This will be connected to a box which the doctor will check daily to determine your progress and recovery. Once it is safe, the chest drain may be removed on POD Day 1 – 3.

In some cases when you have persistent air leak after surgery, the chest drain may be kept and connected to a one-way valve called a Heimlich bag. Caregiver training will be provided upon discharge and you will be reviewed in the clinic weekly to assess the removal of the drain.



After your chest drain is removed, please follow the discharge post-op care listed below:

1. Wound care

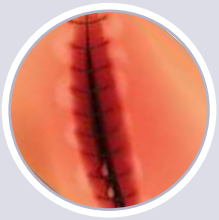
- Shower with mild soap & water
- Ensure surgical wound is thoroughly rinsed
- Dab wound dry with a towel first and then tissue paper
- Do not rub or scratch wound
- Avoid any cream/ointment/powder to the wound
- If there are blue stitches sticking out from your incisional wound, they will be removed on your next clinic visit

2. Signs & symptoms of wound infection as follows:

Unpleasant smell from the wound

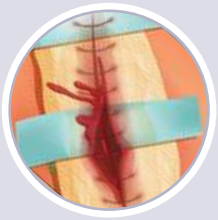
Increasing or persistent pain at the wound site

Fever above 38°C



Redness

Discharges



Excessive bleeding

Call your Thoracic Nurse or Case Manager (office hours 9am-5pm) regarding surgical wound and pain management.

Name card will be provided.

3. Self recovery at home

Incisions

You may continue to experience itchiness or tingling sensations and pain in the chest around the incision area for about 6 months. It may take up to 1 year for the itchiness/tingling sensation to be reduced.

- Soreness and numbness may occur on your incisions, back and shoulders. In the first 4-6 weeks, changes in the weather, lying in one position too long or not getting enough exercise may cause you to feel more stiff and sore.
- Bruising (especially along the incisional wound), will fade and eventually disappear.
- The lump or swelling at the top of your incision will gradually reduce over the next 3 months.
- Sharp, shooting pains that lasts momentarily may take up to 6 months to disappear.

4. Medication adherence

- Take the pain medications as prescribed
- Make sure the medications can last till the next follow-up appointment
- Seek medical help if there are side effects such as rash, fever, vomiting, diarrhea, severe bruising etc.

5. Importance of early exercise and return to physical activity

- Your physiotherapist will provide you with a customized exercise after your surgery.
- You will be encouraged to start early mobility and adequate deep breathing exercises as required.
- Good posture is important for optimal wound healing and maintenance of range and strength.
- Regular walking with slow deep breathing exercises is essential to prevent complications after surgery.
- Avoid any heavy lifting for at least 1 month after surgery.
- Only resume your usual exercise after discussion with your doctor during your next clinic session.

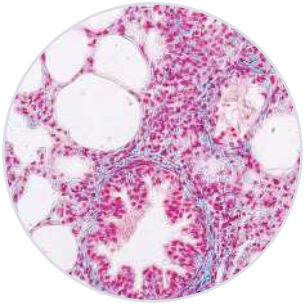
6. Lifestyle and diet modification

- STOP smoking
- Resume a well-balanced diet as soon as possible
- Increased protein intake is encouraged

Seek IMMEDIATE MEDICAL ATTENTION

If you experience any of the following symptoms: fever, dizziness, fainting spells, excessive tiredness, weakness, or having chest tightness and increasing shortness of breath, nausea and vomiting without apparent cause.

When Will I Know My Results?



We send all specimens for full testing under the microscope with the pathologists. This is to be 100% sure of the diagnosis once we have removed the lesion. As such they will usually take 1-2 working weeks for the results to be out. For now, focus on recovering from the surgery.

Staging for Lung Cancers

Depending on various factors such as the size, the extent and the spread of the cancer, it will be assigned a stage. We currently use the 9th edition of lung cancer staging to stage lung cancers. Based on the characteristics of your cancer, your surgeon will explain to you what stage you are at.

TNM 9th - Primary tumor characteristics	
T_x	Primary tumor cannot be assessed
T_0	No evidence of tumor
T_{is}	Carcinoma in situ
T_1	Tumor surrounded by lung/ visceral pleura, or in a lobar or more peripheral bronchus
T1mi	Minimally invasive adenocarcinoma
T_{1a}	⩽ 1 cm
T_{1b}	> 1 to ⩽ 2 cm
T_{1c}	> 2 to ⩽ 3 cm
T_{2a}	>3 cm to ⩽ 4 cm or invades visceral pleura, adjacent lobe or involves main bronchus (up to but not including the carina) or is associated with atelectasis or obstructive pneumonitis extending to the hilar region, involving either part of or the entire lung
T_{2b}	>4 to ⩽5cm
T_3	>5 cm to ⩽7 cm or invades parietal pleura, chest wall, pericardium, phrenic nerve, azygos vein, thoracic nerve roots (i.e. T1, T2), stellate ganglion or separate tumor nodule(s) in the same lobe as the primary
T_4	>7 cm in greatest dimension or invades mediastinum, thymus, trachea, carina, recurrent laryngeal nerve, vagus nerve, esophagus, diaphragm, heart, great vessels (aorta, superior/ inferior vena cava, intrapericardial pulmonary arteries/veins), supra-aortic arteries, brachiocephalic veins, subclavian vessels, vertebral body, lamina, spinal canal, cervical nerve roots, brachial plexus (i.e. trunks, divisions, cords, terminal nerves) or separate tumor nodule(s) in a different ipsilateral lobe than that of the primary
N_x	Regional lymph nodes cannot be assessed
N_0	No regional lymph node metastasis
N_1	Metastasis in ipsilateral peribronchial and/or ipsilateral hilar and/or intrapulmonary lymph nodes, including involvement by direct extension
N_2	Metastasis in ipsilateral mediastinal and/or subcarinal lymph node(s) N2a - Single N2 station involvement N2b - Multiple N2 station involvement
N_3	Metastasis in contralateral mediastinal, contralateral hilar, ipsilateral or contralateral scalene or supraclavicular lymph node(s)
M_0	No distant metastasis
M_1	Distant metastasis
M_{1a}	Tumor with pleural or pericardial nodules or malignant pleural or pericardial effusions, separate tumor nodule(s) in a contralateral lobe
M_{1b}	Single extrathoracic metastasis in a single organ system
M_{1c}	Multiple extrathoracic metastases
M_{1c1}	Multiple extrathoracic metastases in a single organ system
M_{1c2}	Multiple extrathoracic metastases in multiple organ systems

9th Edition TNM Descriptors and Stages						
				N2		
T/M	Categories and Descriptors	N0	N1	N2a	N2b	N3
T1	T1a ≤1 cm	IA1	IIA	IIB	IIIA	IIIB
	T1b >1 to ≤2 cm	IA2	IIA	IIB	IIIA	IIIB
	T1c >2 to ≤3 cm	IA3	IIA	IIB	IIIA	IIIB
T2	T2a Visceral pleura / central invasion	IB	IIB	IIIA	IIIB	IIIB
	T2a >3 to ≤4 cm	IB	IIB	IIIA	IIIB	IIIB
	T2b >4 to ≤5 cm	IIA	IIB	IIIA	IIIB	IIIB
T3	T3 >5 to ≤7 cm	IIB	IIIA	IIIA	IIIB	IIIC
	T3 Invasion	IIB	IIIA	IIIA	IIIB	IIIC
	T3 Same lobe separate tumor nodules	IIB	IIIA	IIIA	IIIB	IIIC
T4	T4 >7 cm	IIIA	IIIA	IIIB	IIIB	IIIC
	T4 Invasion	IIIA	IIIA	IIIB	IIIB	IIIC
	T4 Ipsilateral separate tumor nodules	IIIA	IIIA	IIIB	IIIB	IIIC
M1	M1a Contralateral tumor nodules	IVA	IVA	IVA	IVA	IVA
	M1a Pleural / pericardial effusion, nodules	IVA	IVA	IVA	IVA	IVA
	M1b Single extrathoracic metastasis	IVA	IVA	IVA	IVA	IVA
	M1c1 Multiple metastases in 1 organ system	IVB	IVB	IVB	IVB	IVB
	M1c2 Multiple metastases in >1 organ systems	IVB	IVB	IVB	IVB	IVB

FAQ: My lung cancer is stage _____.

So I'm stage _____, what now?

Your case will be discussed at a multidisciplinary board to get various specialty doctor's input on what is your next best course of action. If it is in the early stage, regular follow up with your surgeon may be enough. If there is a potential to consider further treatment such as chemotherapy, targeted therapy, immunotherapy or radiation therapy, you will be referred to the relevant specialty doctor to discuss the course of action.

I have never smoked, why did I get cancer?

It is increasingly shown that in Asians, there are many non-smokers especially women who develop lung cancer.[1] This is likely due to an underlying gene mutation (eGFR mutation) in your lung. Despite the development of cancer resulting from this mutation, the good news is that there is targeted therapy available to treat cancers arising from this mutation (such as Osimertinib). Consult your oncologist for the best option to treat your disease.

I do not want chemotherapy as I am scared of it

Chemotherapy has improved greatly over the past few years. Nowadays, there are many newer and safer medicines that can help improve your survival even after surgery. Continual research and development efforts in the pharmaceutical industry may yield novel drug candidates, potentially leading to the introduction of new medications into the market. Check with your oncologist if you are eligible for the following targeted therapy or immunotherapy options.

eGFR inhibitors
(e.g. Osimertinib)

ALK, ROS1 inhibitors
(e.g. Crizotinib)

Checkpoint inhibitors
(e.g. Durvalumab, Pembrolizumab)

Monoclonal antibodies
(e.g. Bevacizumab)

Reference: 1. Yang P. PS01. 02 national lung cancer screening program in Taiwan: the TALENT study. Journal of Thoracic Oncology. 2021 Mar 1;16(3):S58.

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National University Heart Centre, Singapore (NUHCS)

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- NUHCS at National University Hospital (NUH), Kent Ridge - Main Operations
  Main Building Zone F
  Operating Hours: 8:00am - 5:30pm (Monday - Friday)
  Closed on Weekends & Public Holidays

- NUHCS Heart Clinic @ Ng Teng Fong General Hospital (NTFGH)
  Tower A - Specialist Outpatient Clinics Level 3, Clinic A34
  Operating Hours: 8:30am - 5:30pm (Monday - Friday)
  8:30am - 12:30pm (Saturday)
  Closed on Sundays & Public Holidays

- NUHCS Heart Clinic @ Alexandra Hospital (AH)
  Operating Hours: 8:30 am - 5:30 pm (Monday - Friday)
  Closed on Weekends & Public Holidays

- NUHCS Heart Clinic @ Jurong Medical Centre (JMC)
  Operating Hours: 8:30 am - 5:30 pm (Monday - Friday)
  Closed on Weekends & Public Holidays

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