Understanding Cancer

A SERIES OF SIMPLE EDUCATIONAL VIDEOS FOR THE GENERAL PUBLIC

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Part 18: Other diagnostic techniques for cancer

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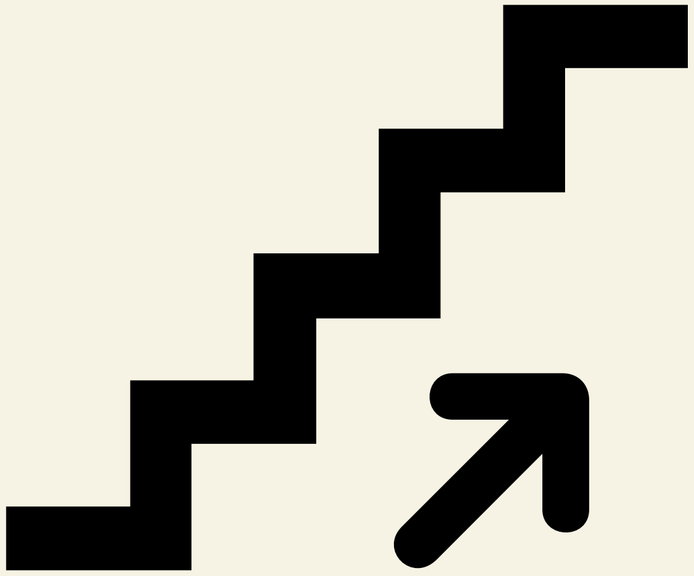
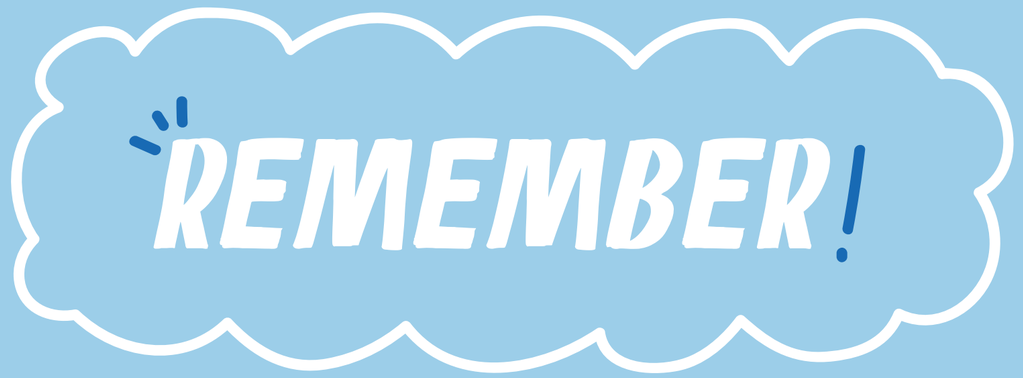
In this video series, we looked at the key steps involved in detecting cancer.



Here is a recap...



Biopsy

CONFIRMED DIAGNOSIS

X-rays and Scans

Laboratory test on blood, Urine, Stool

Physical examination

Medical history

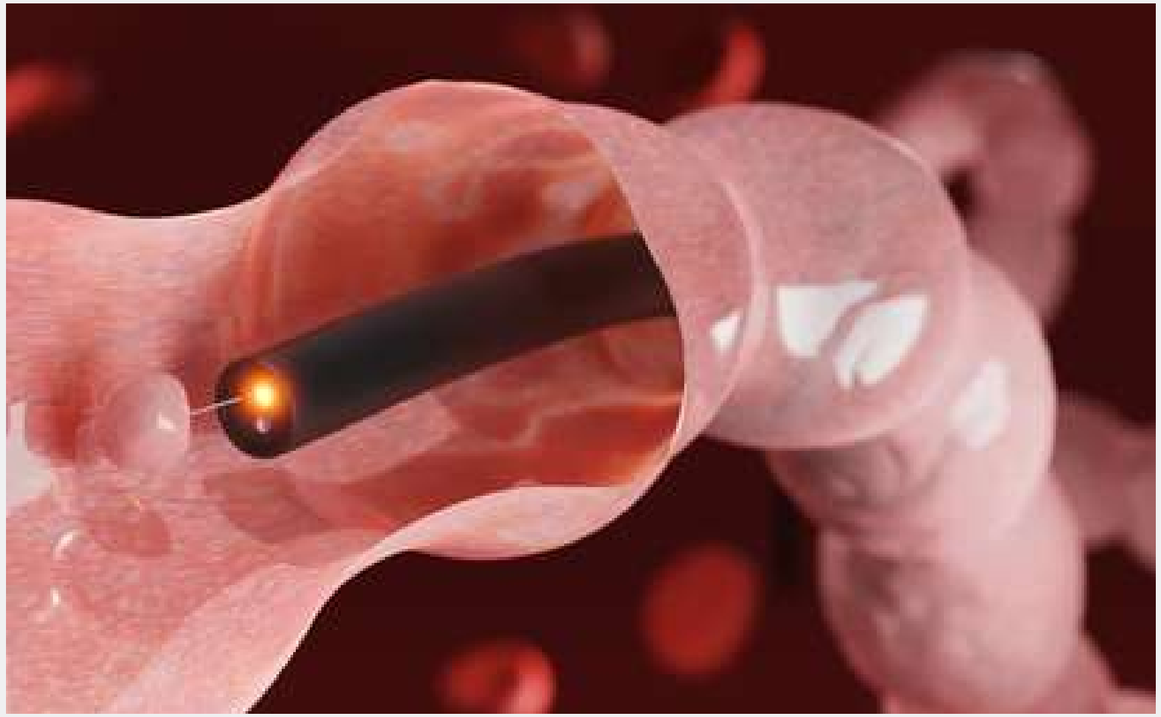
There are more tests involved but are specialised to the organ or type of cancer.

There are many types of thin flexible tubes with a camera at the end and has an ending of:

OPY

We have looked so far at:

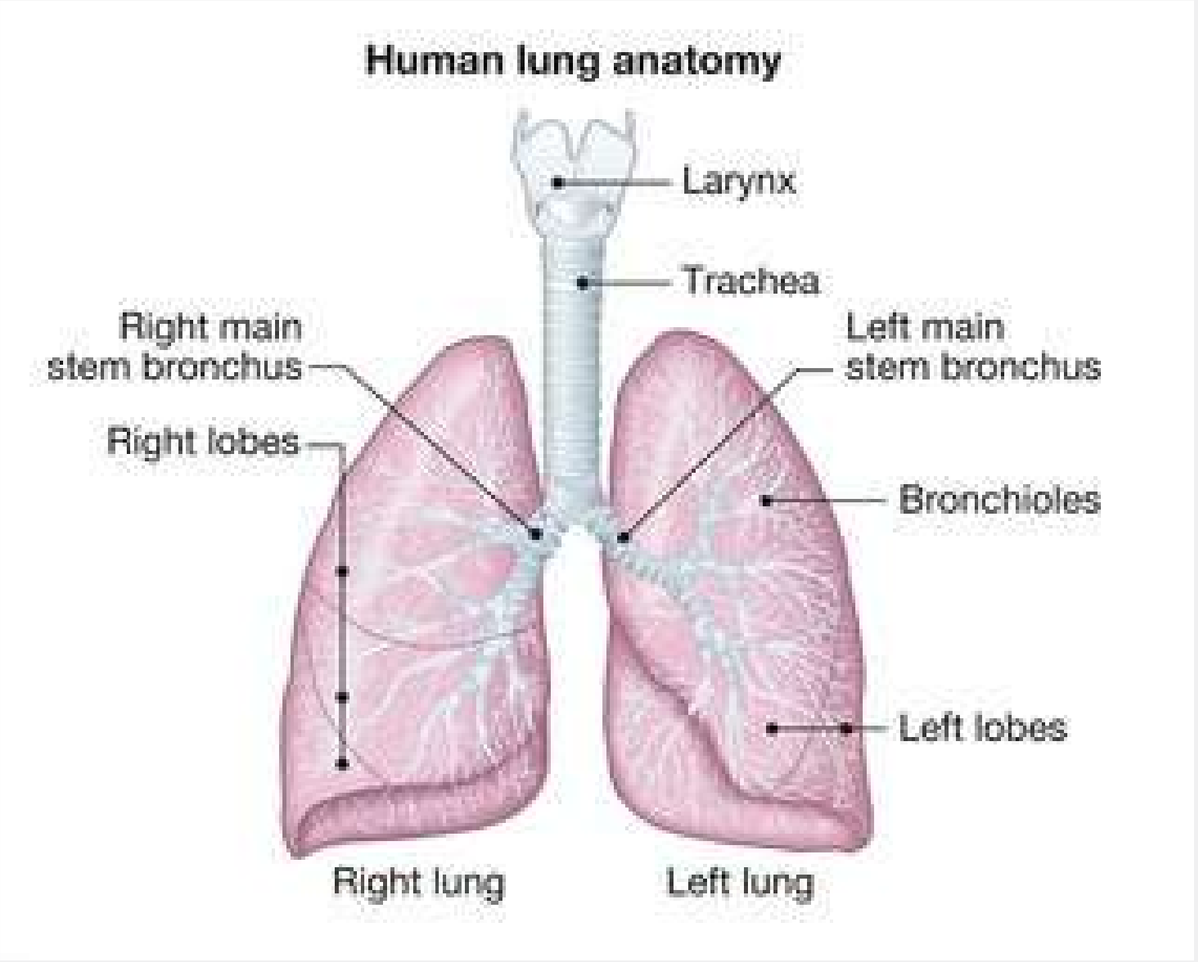
- **COLONOSCOPY**
- **ENDOSCOPY**
- **COLPOSCOPY**



Here are other examples

Laryngoscopy

The flexible tube called a laryngoscope goes through the throat to examine the larynx.



This helps to detect laryngeal cancer.

Laryngoscopy

A general anaesthetic is given and biopsy may be taken from areas that does not look normal.

This helps to detect laryngeal cancer.

Laryngoscopy

The sample is examined using a microscope by a pathologist.

This helps to detect laryngeal cancer.

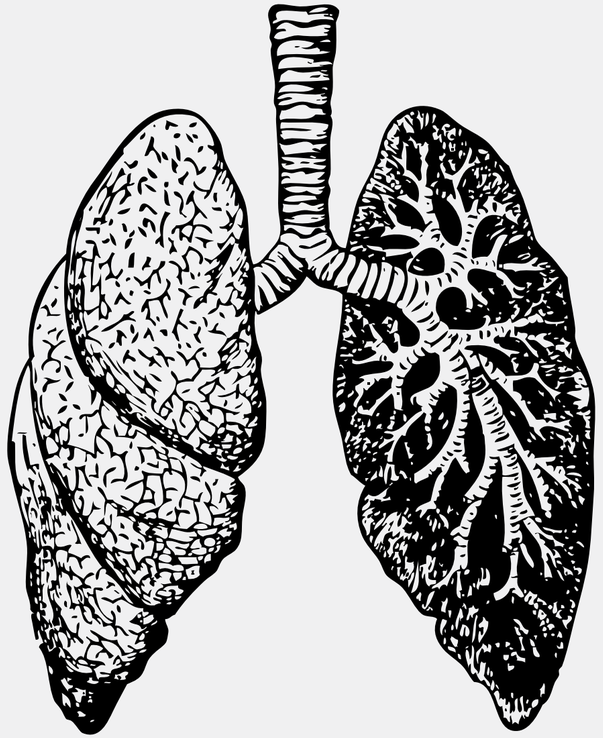
LARYNGOSCOPY

THE EXAMINATION BELOW THE BACK OF THE THROAT FOR THE VOICE BOX (LARYNX) THAT CONTAINING THE VOCAL CORDS IS LOCATED

Bronchoscopy with CT scan and Endoesphageal ultrasound (EUS)

Trachea is the windpipe that connects the mouth to the lungs.

Bronchi (one of the main branches or channels where air enters from the trachea to the lungs).

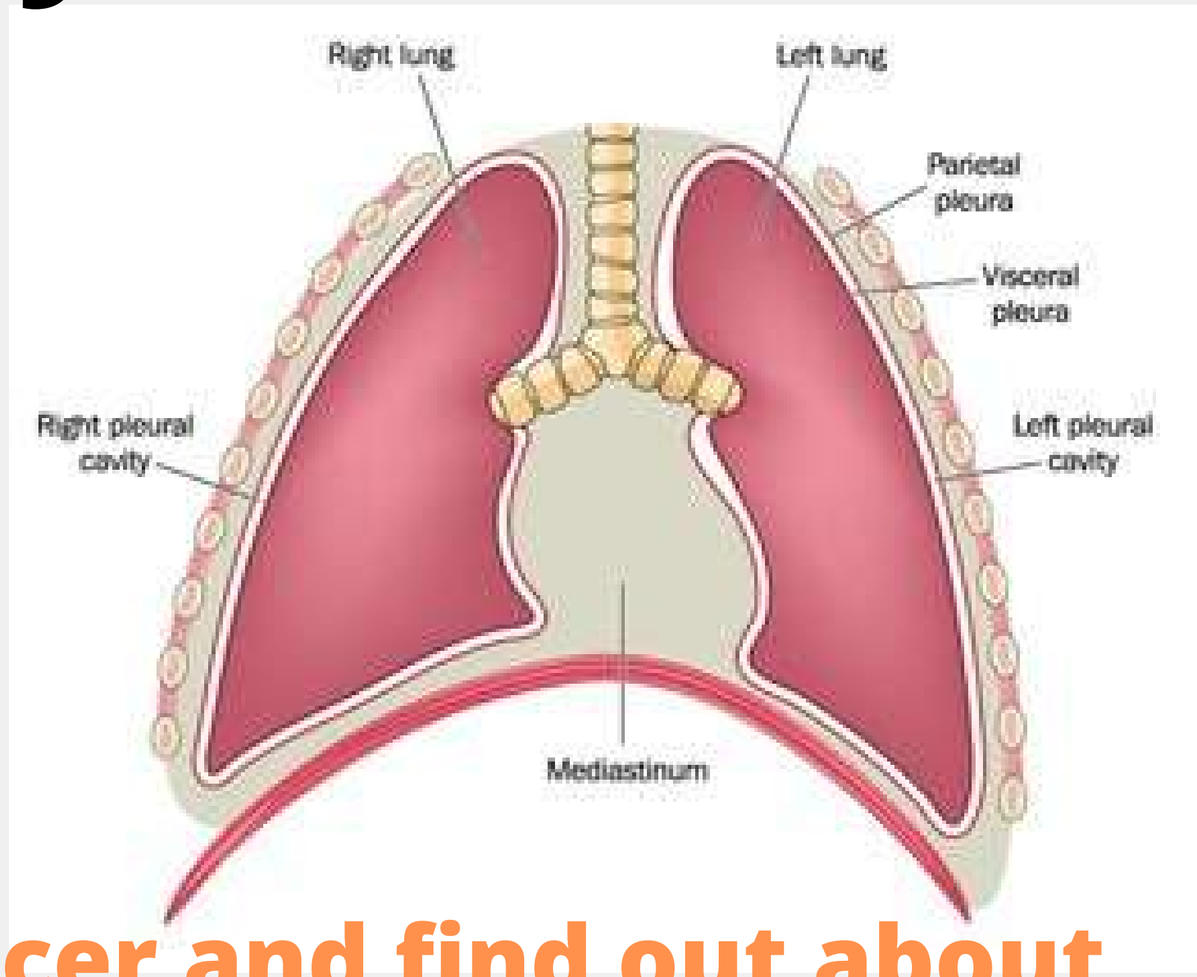


This helps to see whether the cancer has spread the trachea and the bronchi.

Mediastinoscopy

A small cut in the skin is made at the bottom of the neck where the flexible tube enters the chest in the middle (mediastinum).

This is done to look at the chest and the lymph nodes.

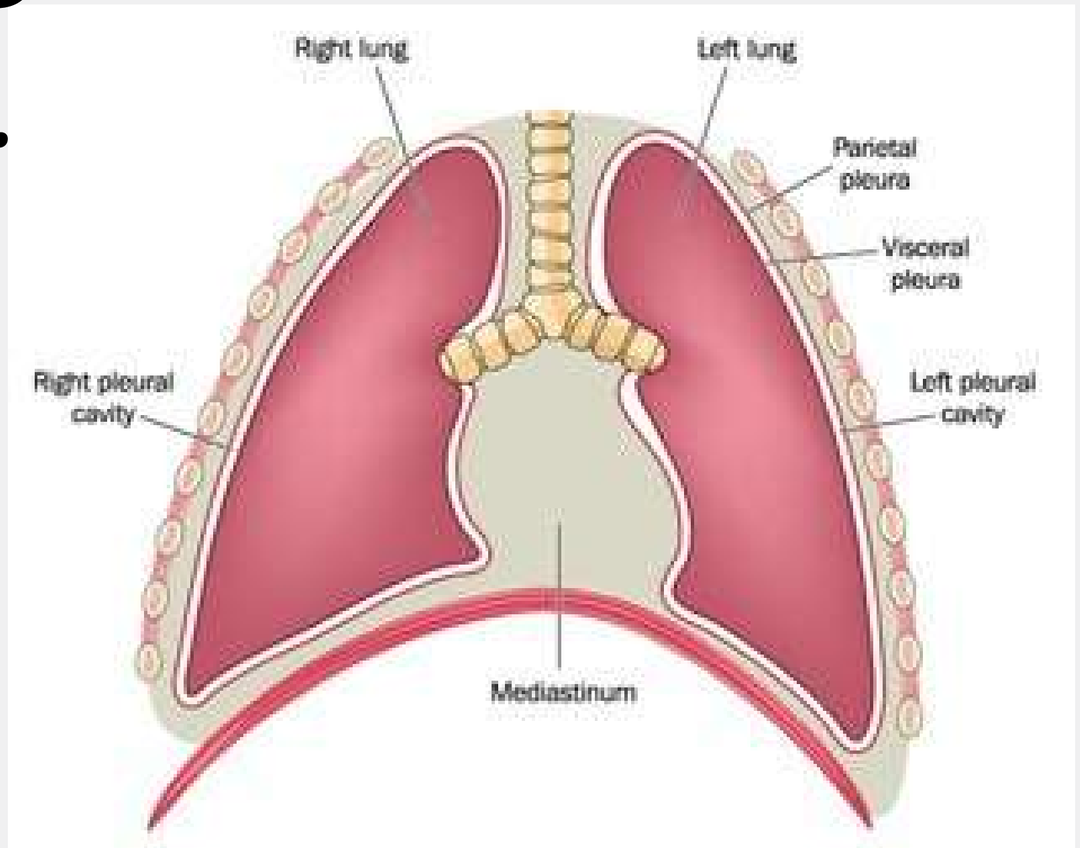


This helps detect lung cancer and find out about the size, position and whether it has spread.

Mediastinoscopy

A general anaesthetic is used.

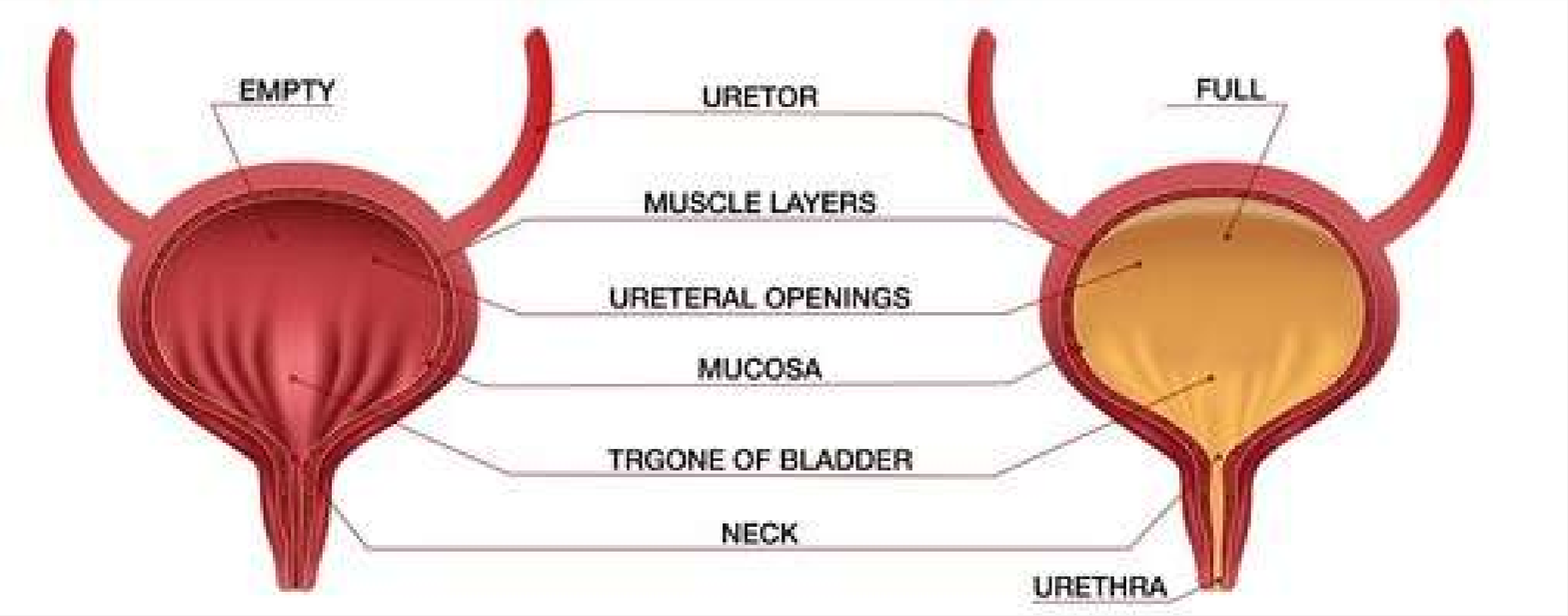
Biopsies may be taken of the lymph nodes and tissues.



This helps detect lung cancer and find out about the size, position and whether it has spread.

Cystoscopy

This method is to look at the bladder.
The bladder is the organ that stores urine.
In men, it is on top of the penis.
In women, it is above the vagina.



It can help detect bladder cancer.

Cystoscopy

It is done under general anaesthesia.

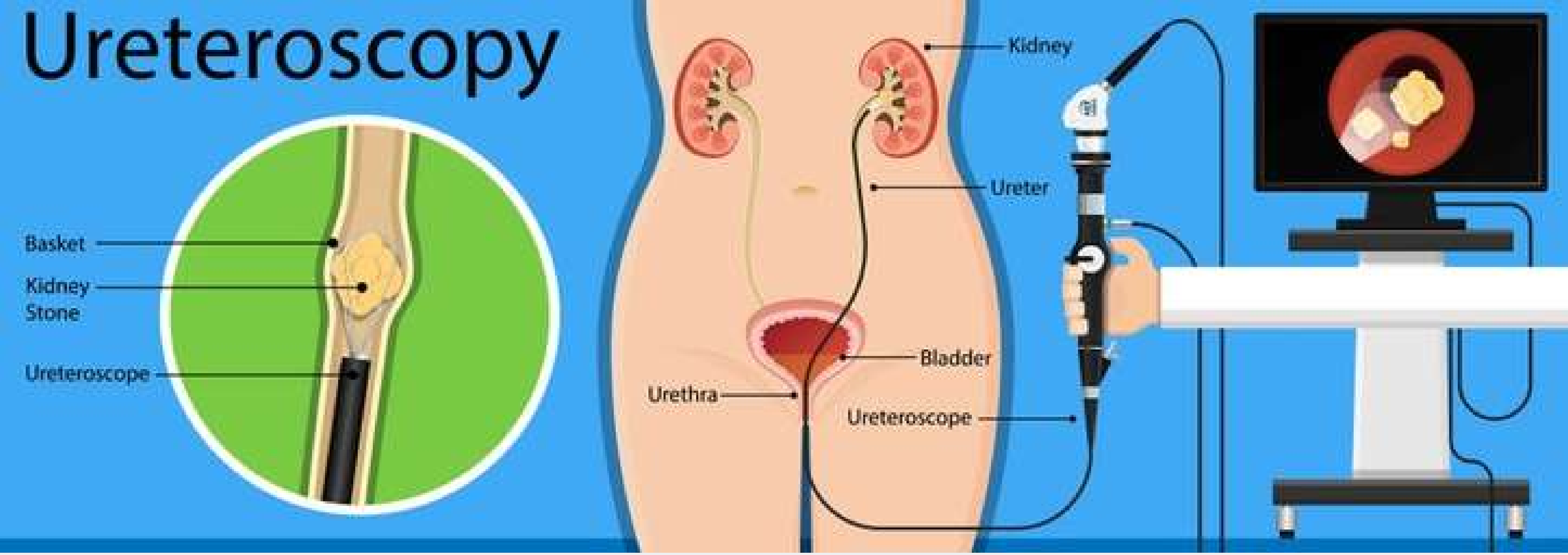
The flexible tube called a cystoscope starts from the ureter (the tube that connects the kidneys to the bladder) to enter the bladder.

It can help detect bladder cancer.

Cystoscopy

Biopsies are taken for abnormal areas to be examined under the microscope.

This is to detect bladder cancer.



This is to look at the ureter.

It is done under general or local anaesthesia.

This helps detect the cancer of the ureter.

Utereroscopy

The uterescope starts from the ureter into the bladder and further into the urethra.

Biopsies are taken for examination under the microscope.

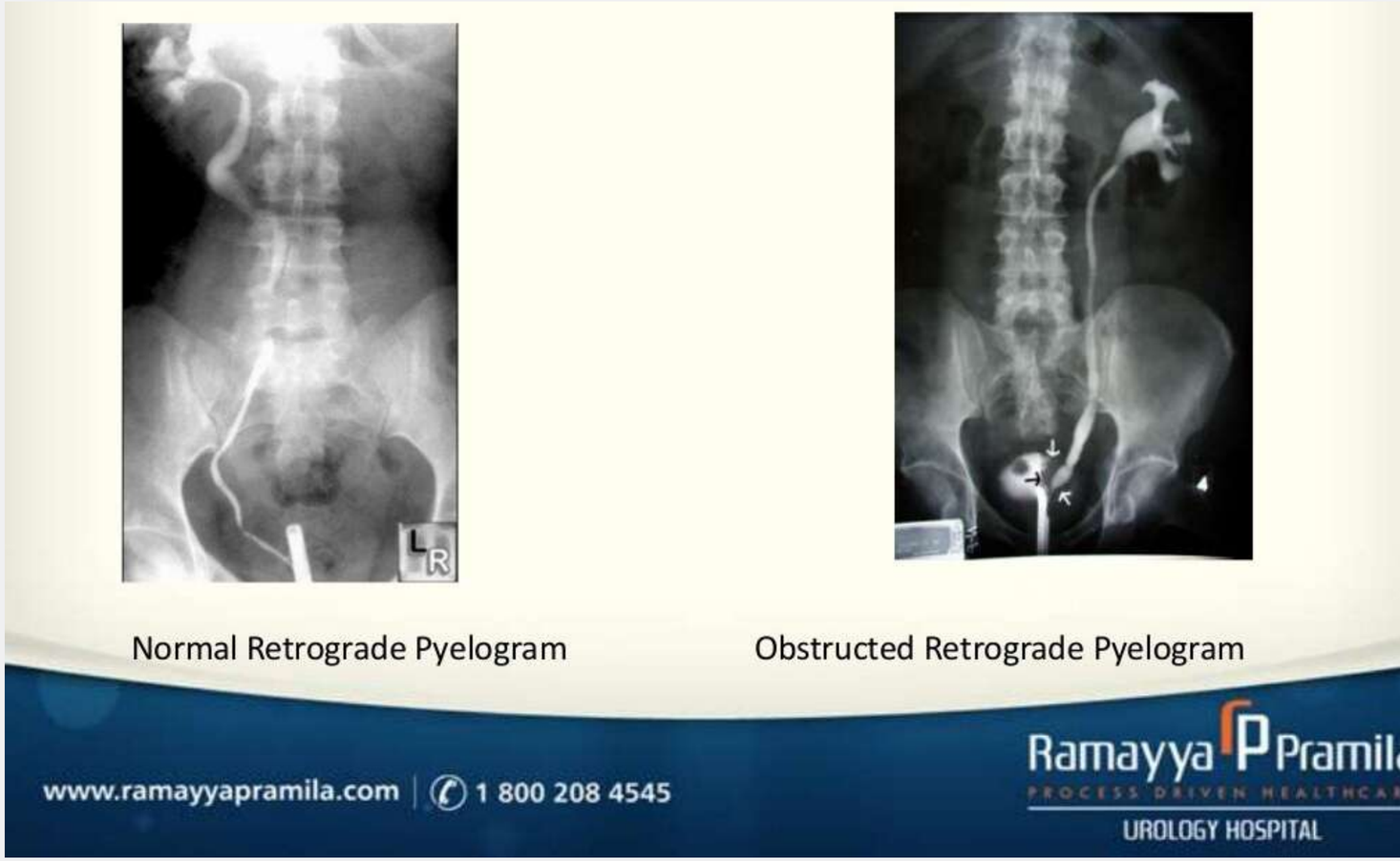
This helps detect the cancer of the ureter.

Sometimes a sample of urine (pee) is taken to test for cancer.

Retrograde pyelography

Sometimes x-rays of the kidney and ureter are taken.

A dye is entered through a tube called a catheter to increase quality of imaging.



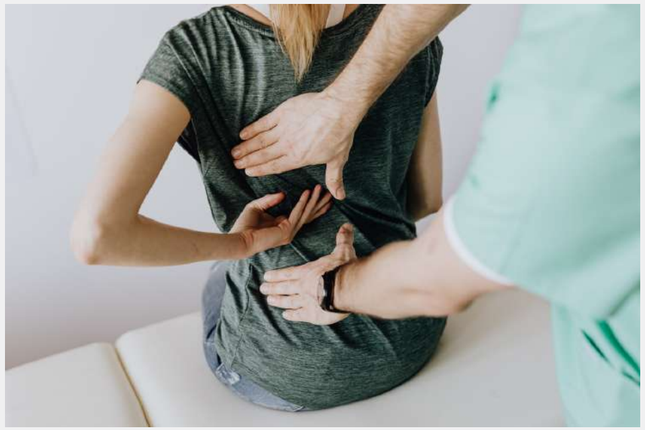
Side effects for cystoscopy and uterescopy

Blood may be present in urine.

Pain when passing pee.

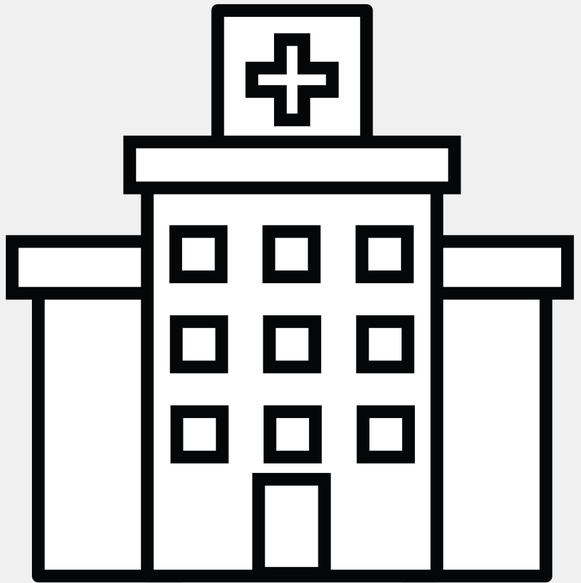
Pain in the stomach and back.

This may occur for a few days.



Side effects for cystoscopy and uterescopy

If longer than few days it may mean there is an infection and to contact the hospital.



Some ____opy are more invasive and require surgery.

Video-assisted thoracoscopy (VATS)

It allows to look in the chest and identify any lung and chest issues.

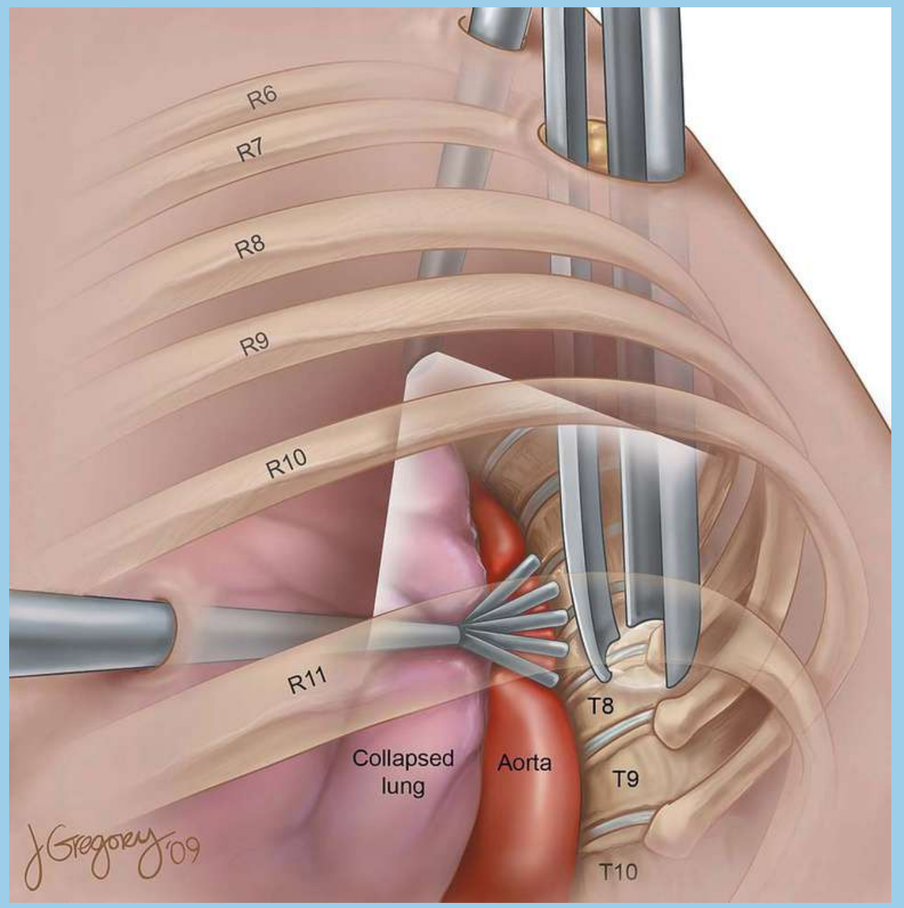
A small camera enters the chest through a small cut (incision) being made in the ribs.

Video-assisted thoracoscopy (VATS)

Three cuts are made: 2 small ones and one between 3-8 cm.

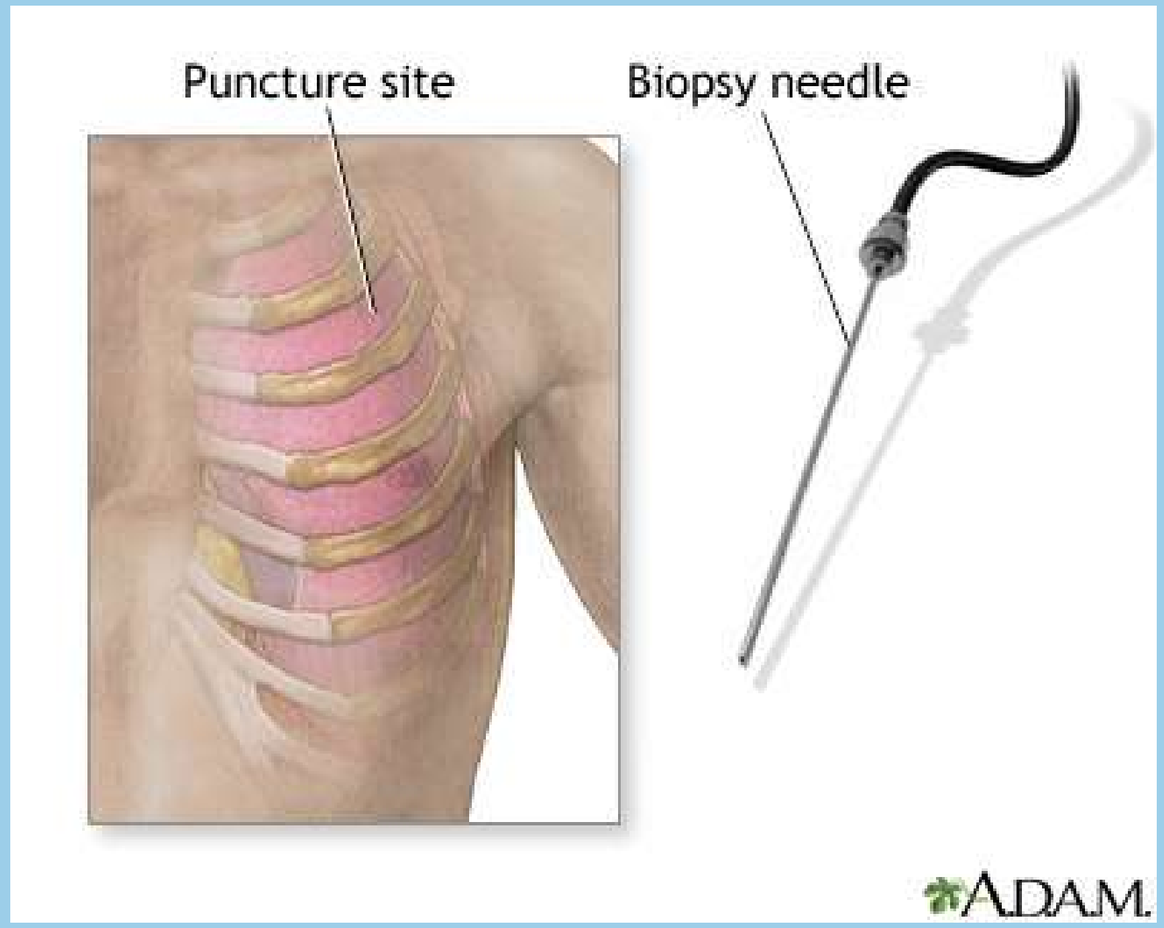
The small cut to enter the camera.

The larger cut is for utensils used.

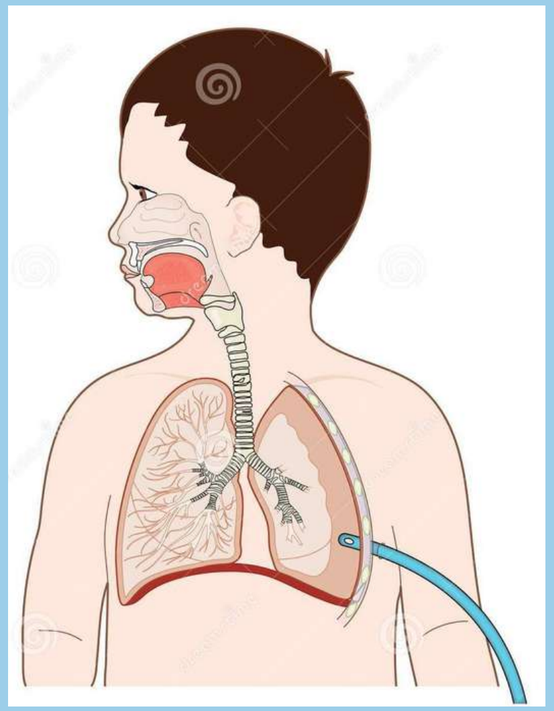


Video-assisted thoracoscopy (VATS)

Biopsy may be taken from the lung, lining of the lung (pleura).



Video-assisted thoracoscopy (VATS)



Fluid may be drained from the chest and other areas.

A drain is added into the chest for several days until the lung returns to normal size.

Laproscopy

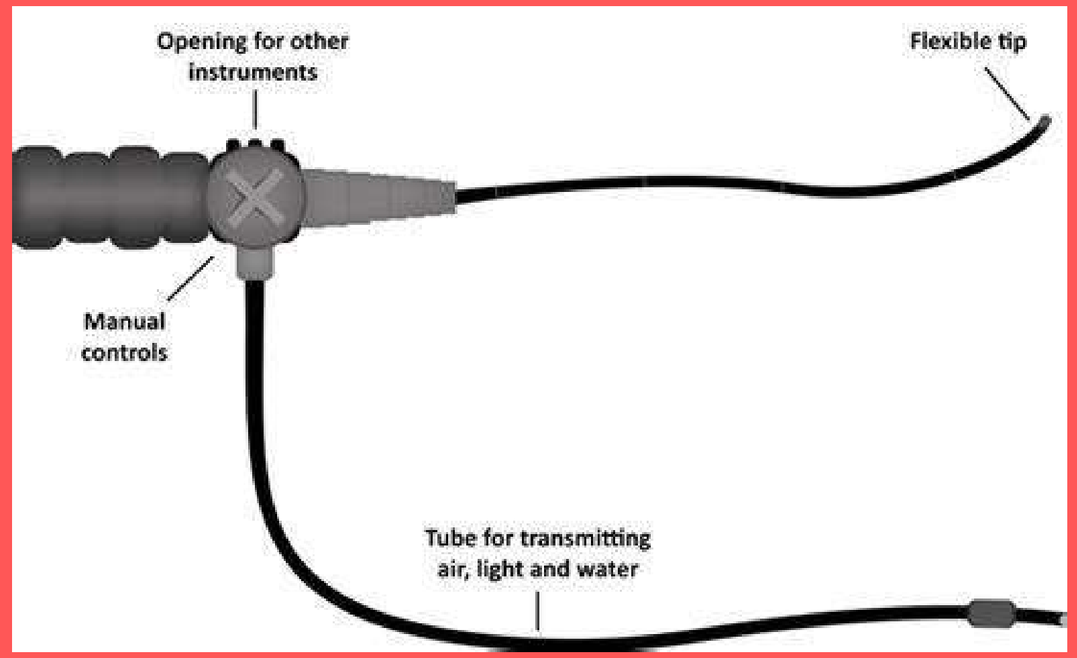
A key hole surgical procedure to see the stomach and pelvis.

It requires general anaesthetic.

It helps detect gastrointestinal tumours to detect metastases in the liver and the coelic lymph node.

Endoscopic retrograde cholangio-pancreatography

The flexible tube called an endoscope enters down the throat into the stomach and first area of the small intestine (duodenum) to find the opening of the bile and pancreatic ducts.

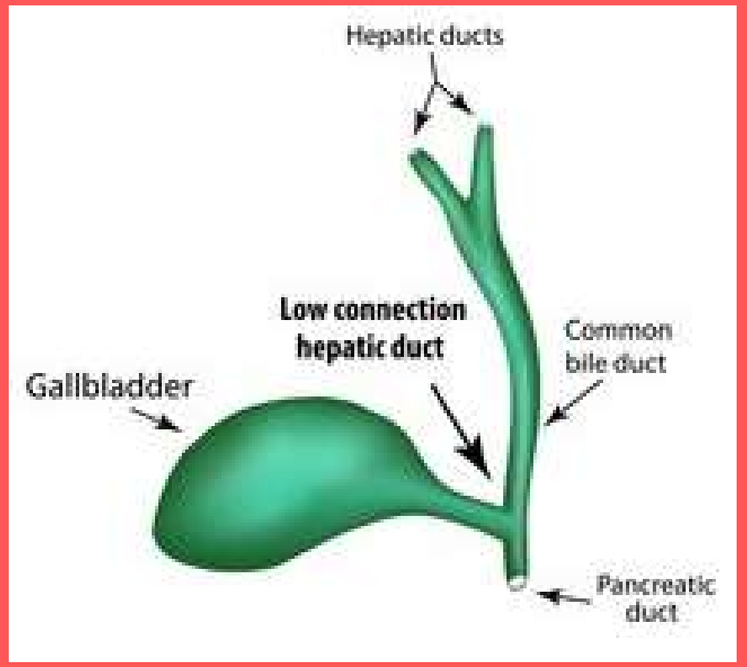


It helps detect bile duct, gall bladder and pancreatic cancers.

Endoscopic retrograde cholangio-pancreatography

The sedative helps remove pain or discomfort.

The bile duct is a tube that drains bile out of the liver and into the small bowel.



It helps detect bile duct, gall bladder and pancreatic cancers.

Endoscopic retrograde cholangio-pancreatography

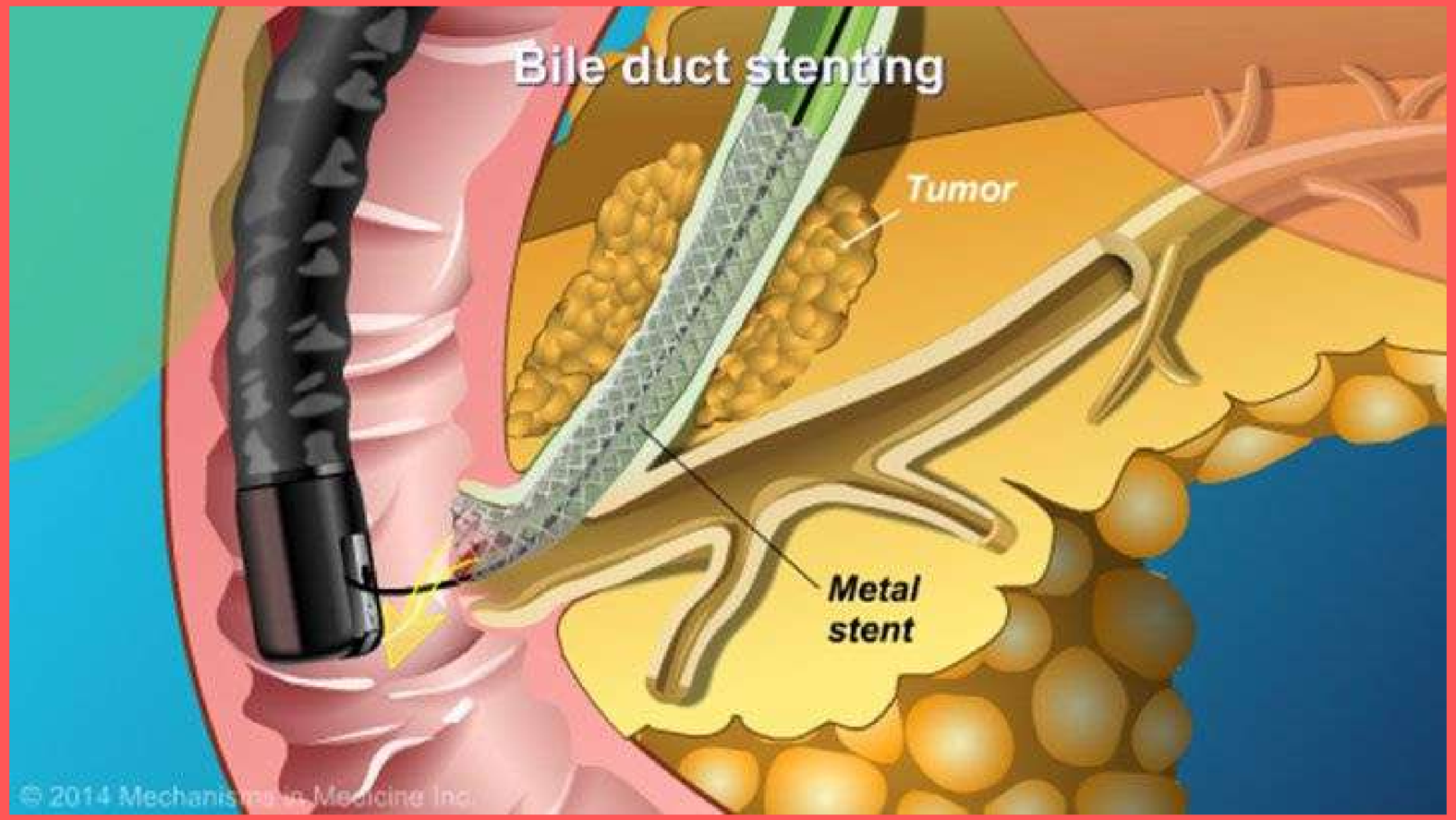
It helps to see whether is jaundice.

Jaundice is when your skin or the whites of your eyes turn yellow.

It helps detect bile duct, gall bladder and pancreatic cancers.

Endoscopic retrograde cholangio-pancreatography

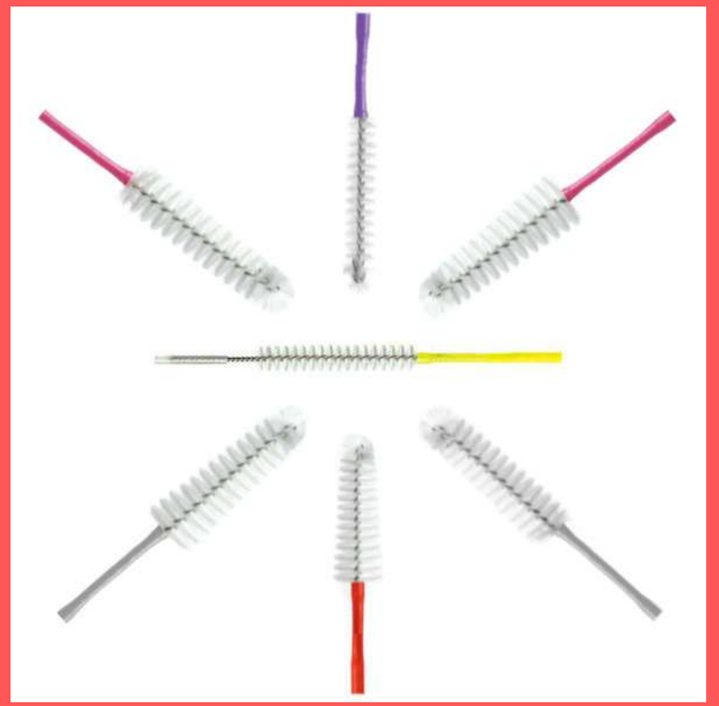
This may mean the bile ducts are blocked and needs unblocking using a small tube called a stent.



It helps detect bile duct, gall bladder and pancreatic cancers.

Endoscopic retrograde cholangio-pancreatography

Biopsy may be taken during the tests for any abnormal cells using a small brush down the endoscopy and sent to check in a laboratory.



It helps detect bile duct, gall bladder and pancreatic cancers.

Endoscopic retrograde cholangio-pancreatography

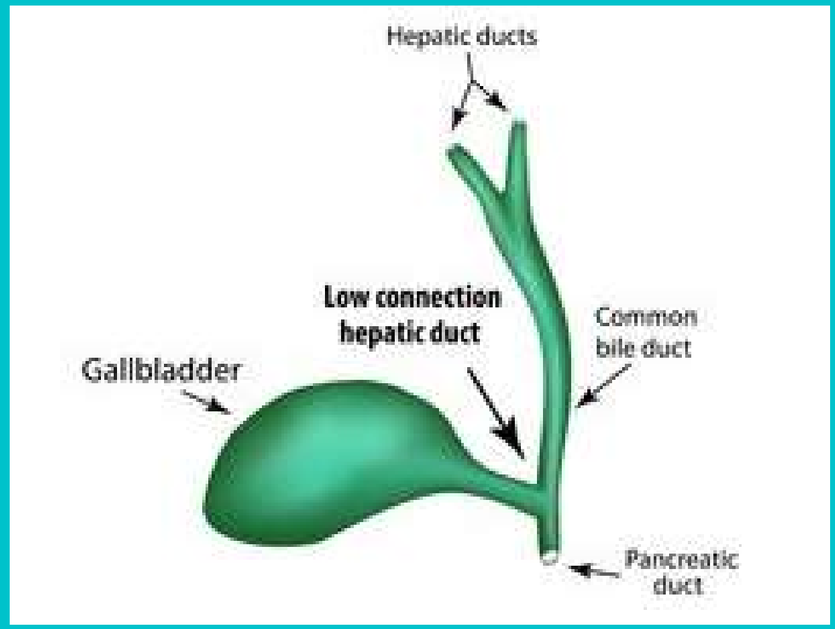
X-rays may be taken where a dye is injected to see more clearly.

It helps detect bile duct, gall bladder and pancreatic cancers.

Percutaneous transhepatic cholangiogram (PTC)

X-ray of the bile duct or gall bladder.

It helps detect any blockages in the bile duct and if present a stent is added.



Percutaneous transhepatic cholangiogram (PTC)

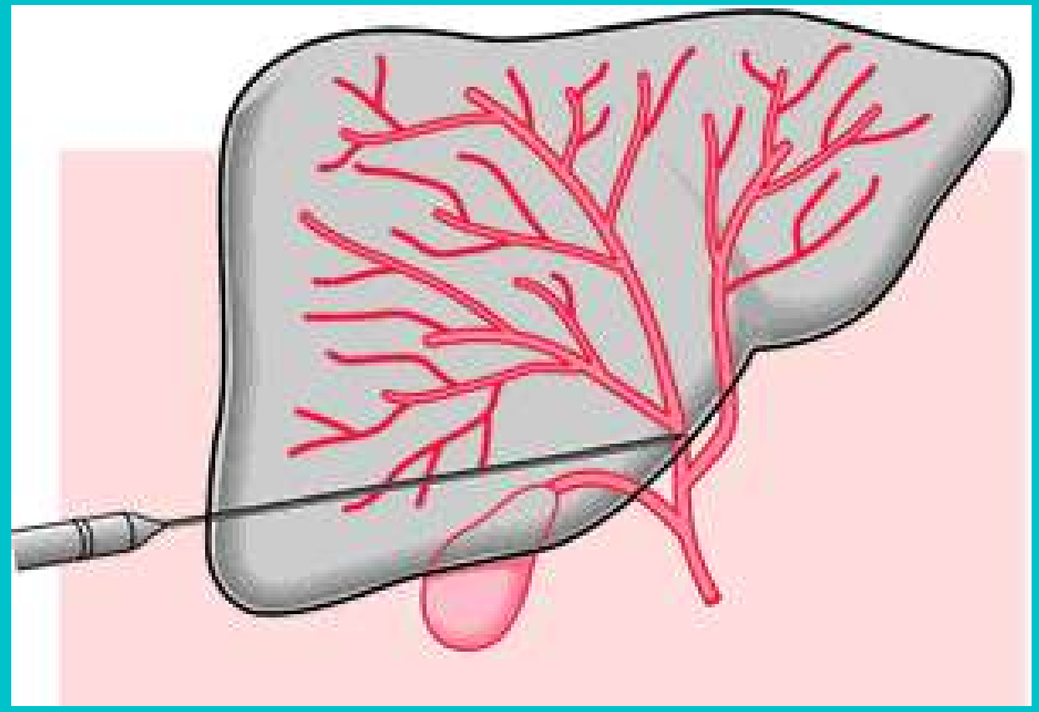
Doctor will inform not to eat or drink for a few hours and to take antibiotics before and after the test.

Sedative may also be given and a local anaesthetic is added into the skin.

Percutaneous transhepatic cholangiogram (PTC)

A long, thin, flexible needle is added through the skin and into the liver.

X-ray images provide guidance and once the needle is in the bile duct, the dye is injected.



Sputum

A sample of a gooey substance that comes from the chest is called a sputum culture.

Sputum

It is also known as phlegm.

It consists of germs and white blood cells that fight infection and is caused by risk factors in the environment i.e. smoke, chemicals and pollution.

Sputum

Coughing can remove the phlegm.

Sputum helps detect infection or illness of the lungs i.e. tuberculosis, bronchitis and pneumonia.

Sputum

Prior to the test, the doctor may ask to drink water, skip a meal or stop taking antibiotics that kill bacteria.

A sample of 5 ml is required for the test.

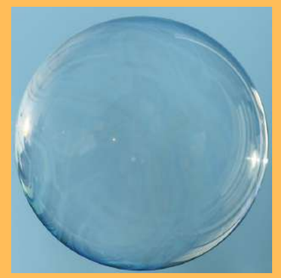
Sputum

It is sent to the laboratory to see what the germ or microbe is a bacteria, virus or fungi or another pathogen.

Sputum results

White, clear, yellow, green.

Sputum has high levels of white blood cells and may indicate pneumonia or bronchitis.

Sputum results

Red or orange-brown (rust)

It may indicate bleeding and is more serious.

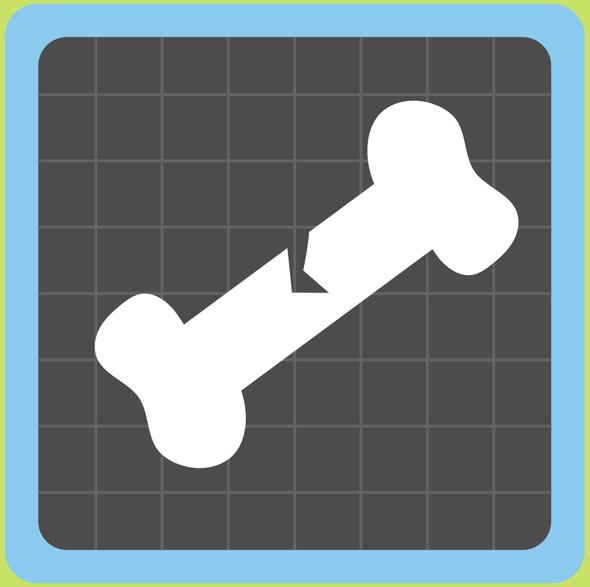
Sputum results

Grey or black

Those work in locations like coal mines may have this result.

Bone scan

This helps detect any abnormal parts (hot spots) of the bone.



It can help detect cancer, arthiritis and other conditions.

Bone scan

It is more sensitive than x-ray where abnormal bone absorbs more radiation than normal bone.

Figure 1

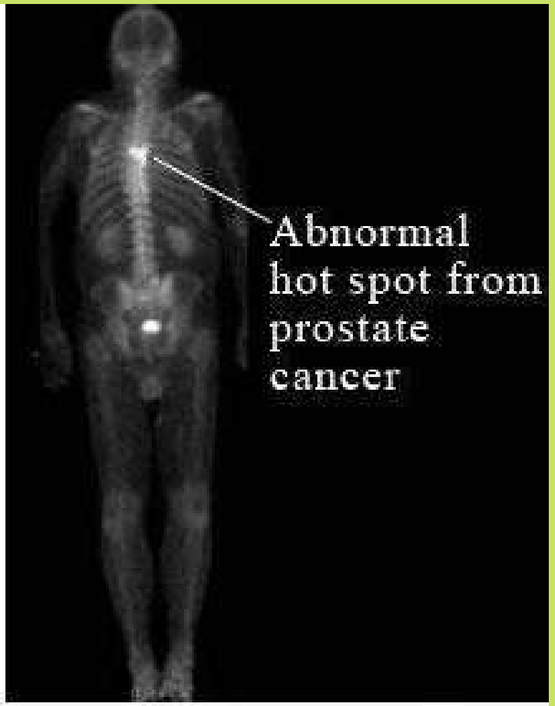


Figure 2

It can help detect cancer, arthiritis and other conditions.

Bone scan

A radiative substance is injected into the vein in the arm or hand and images are taken 2 to 3 hours later.

It can help detect cancer, arthiritis and other conditions.

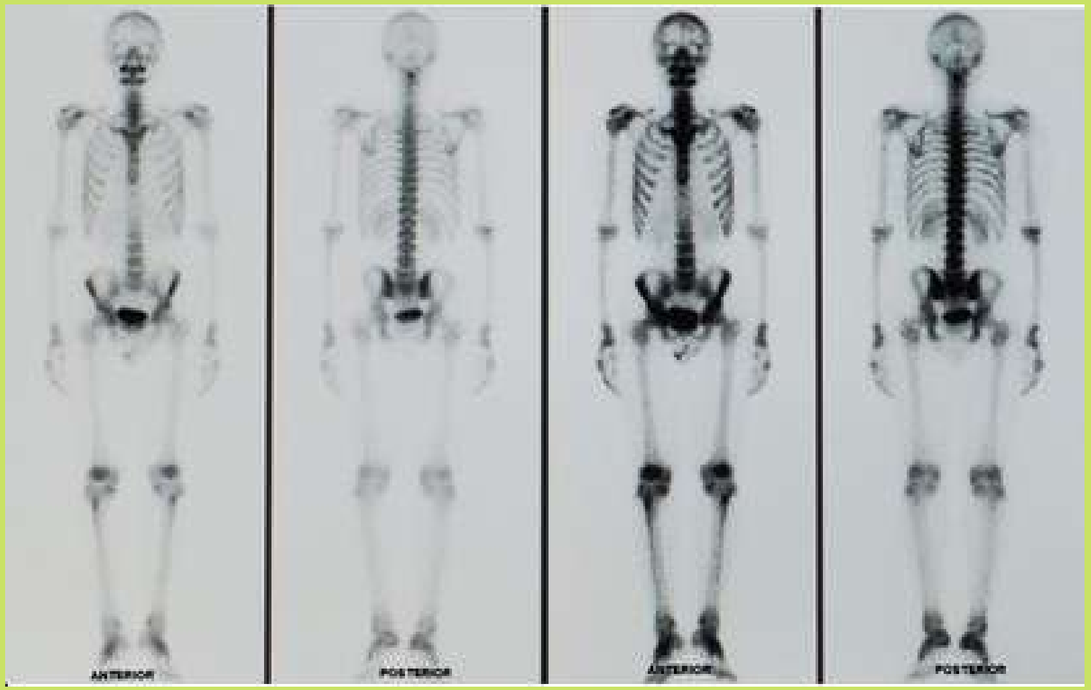
Bone scan

Further tests using CT or MRI can help provide further information to make a diagnosis.

It can help detect cancer, arthiritis and other conditions.

Skeletal Scintigraphy

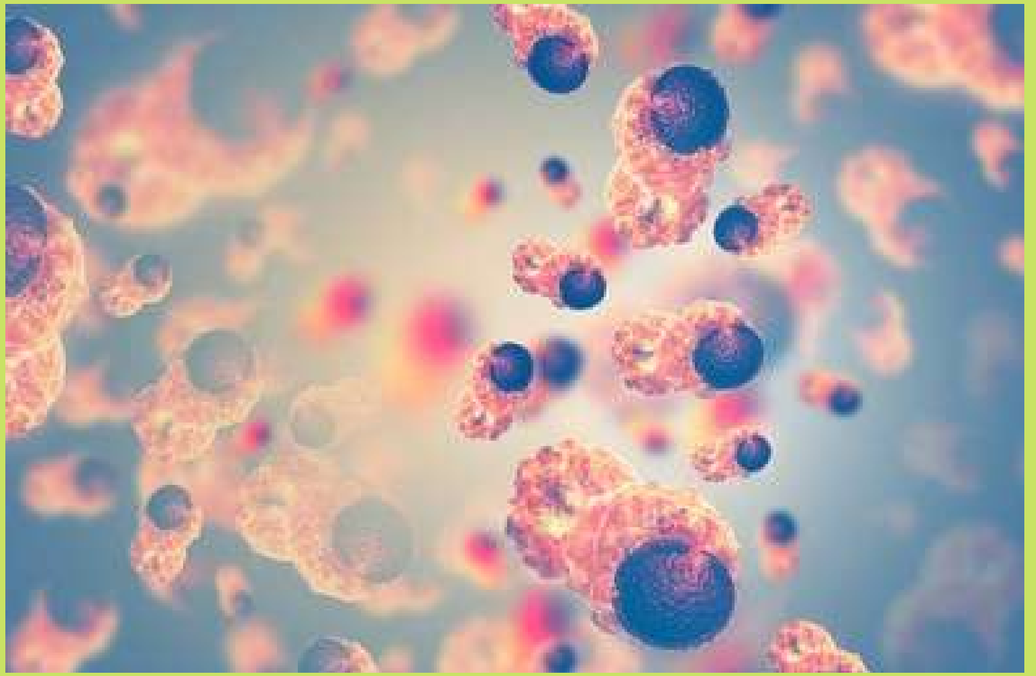
This is a type of bone scan that helps detect and monitor patients with primary and advanced tumours, infections and fractures (broken bones).



Montilla-Soler JL and Makanji R. (2017) Skeletal Scintigraphy. Cancer Control. 24(2):137-146.

Skeletal Scintigraphy

It may help in patients with advanced prostate cancer, breast cancer and osteosarcoma (bone cancer).



Montilla-Soler JL and Makanji R. (2017) Skeletal Scintigraphy. Cancer Control. 24(2):137-146.

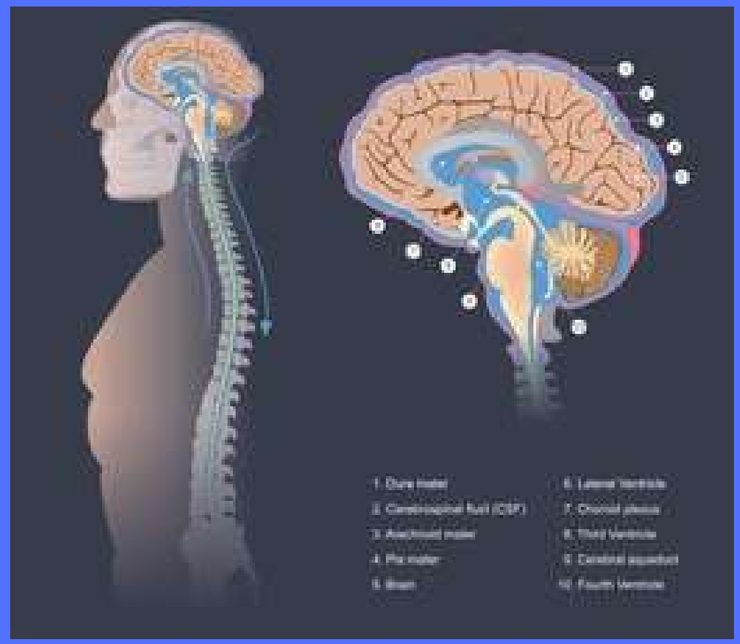
Skeletal Scintigraphy

Small amounts of radiative material is used i.e. fludeoxyglucose F 18, sodium fluoride F 18 with imaging to improve sensitivity and accuracy.

Montilla-Soler JL and Makanji R. (2017) Skeletal Scintigraphy. Cancer Control. 24(2):137-146.

Lumbar puncture

Cerebrospinal fluid (CSF) is the fluid that surrounds the brain and spinal cord.



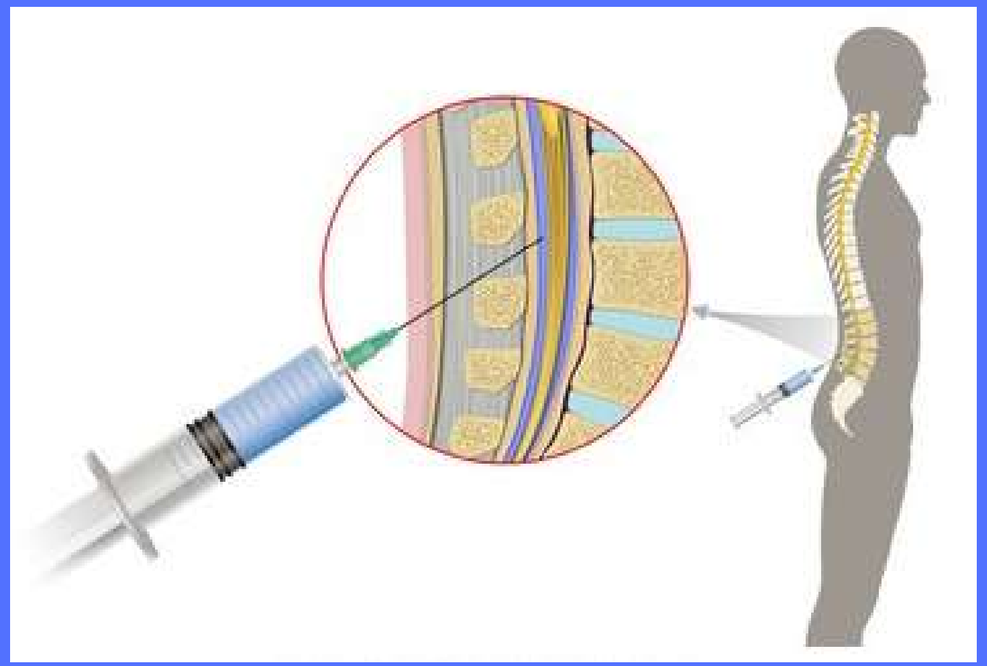
Lumbar puncture

This is collected to:

- *Assess CSF: pressure, infection.*
- *Check for cancer cells*
- *Chemotherapy – it kills cancer cells and is injected into CSF (intrathecal chemotherapy).*
- *Medications e.g. painkillers.*

Lumbar puncture

A sample of the CSF is taken via a hollow needle between the bones of the lower back and into CSF of the spinal cord by a doctor or specialist nurse.



Lumbar puncture

Prior to the test, the patient must inform if they are taking any blood-thinning medications.

Lumbar puncture

This is done under local anaesthesia where the patient is lying on the side or sitting up.

The doctor may ask to pull knees towards chest and tuck in chin.

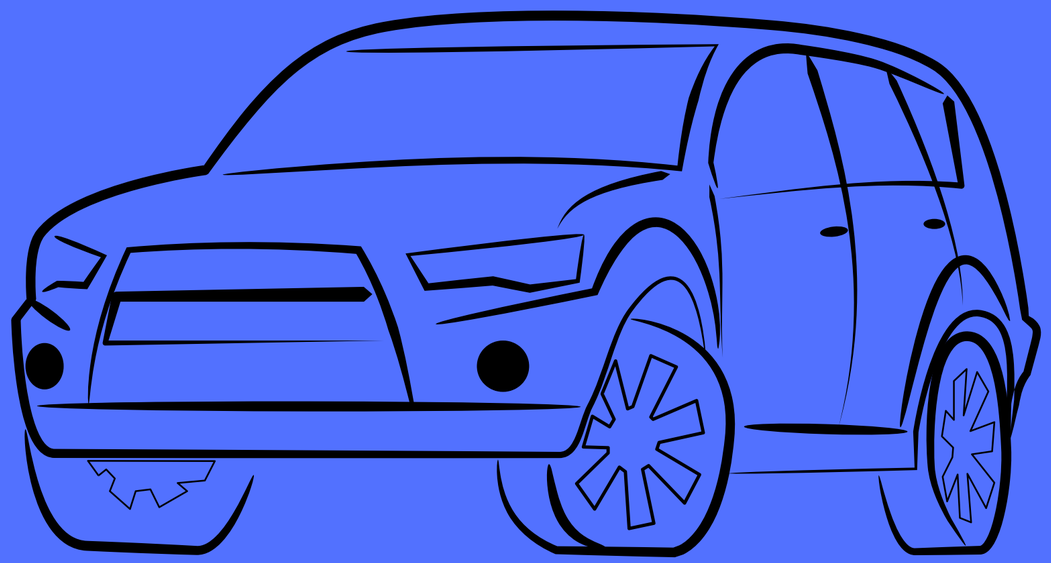
Lumbar puncture

A plaster or small dressing is added and asked to lay flat for half an hour.

Blood pressure and pulse are also taken.

Lumbar puncture

After the test, the patient must be taken home by a family or friend and not use machinery for next 24 hours.



Lumbar puncture

The sample is examined under the microscope.

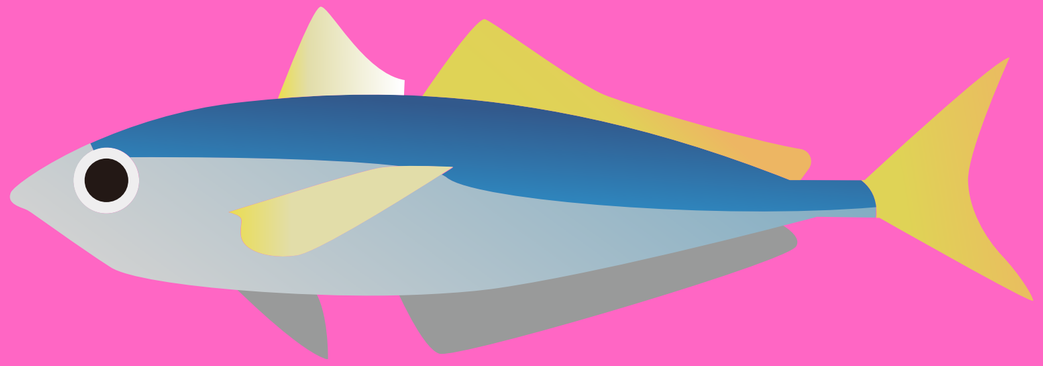
Side effects of lumbar puncture

- *Headaches*
- *Swelling*
- *Bruising or back pain may occur for a few days.*
- *Patient should drink lots of water (3 litres a day).*

If longer, inform your doctor.

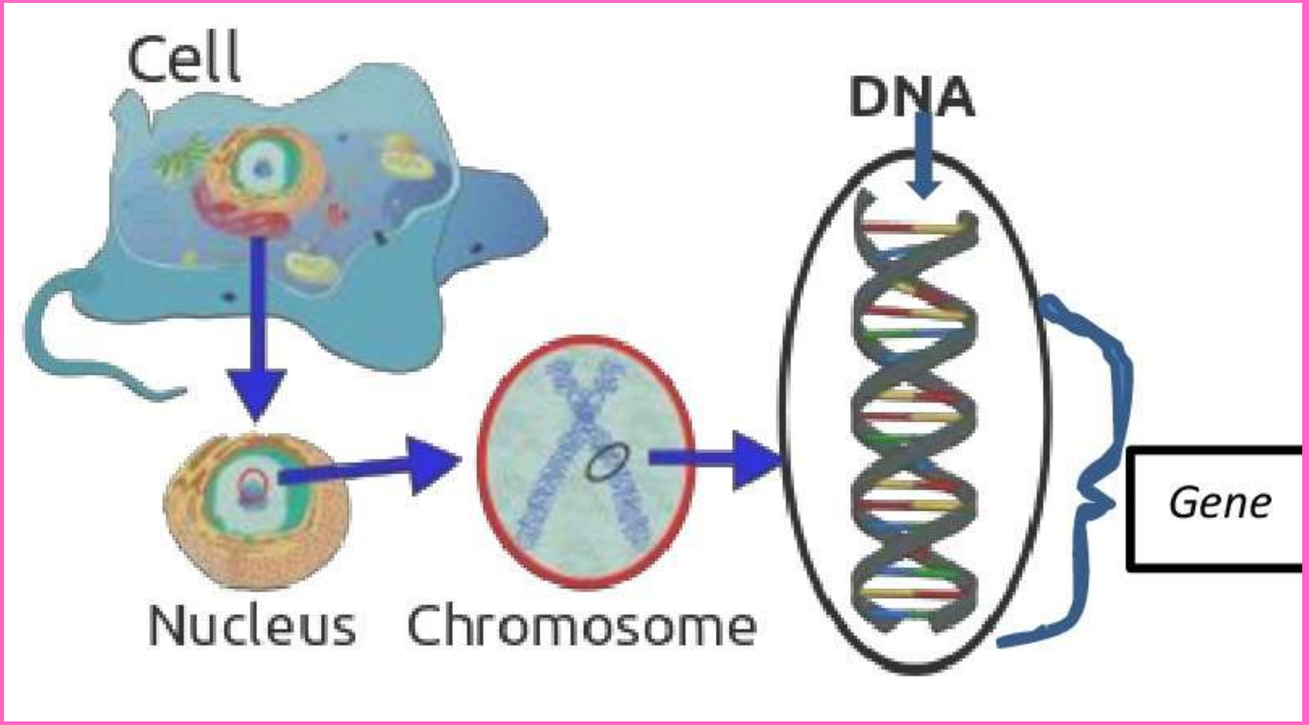
FISH test

It has nothing to do with fish that swims.



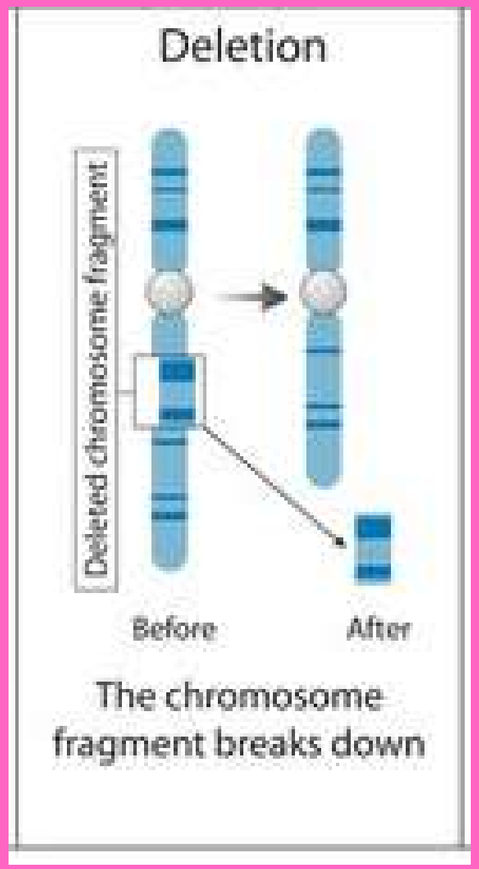
FISH test

Fluorescence in situ hybridization (FISH) is a test that maps the genetic material and look at changes in genes or chromosomes (cytogenetic tests).



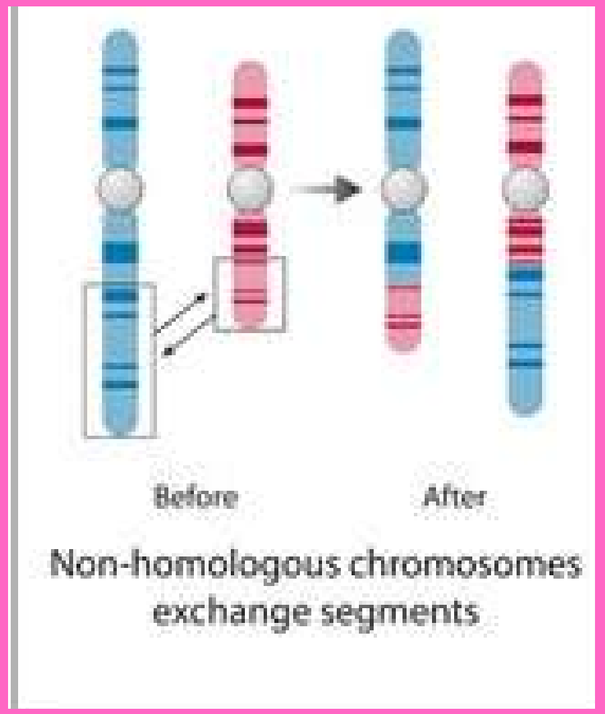
FISH test

Has the gene or chromosome have been deleted or missed?



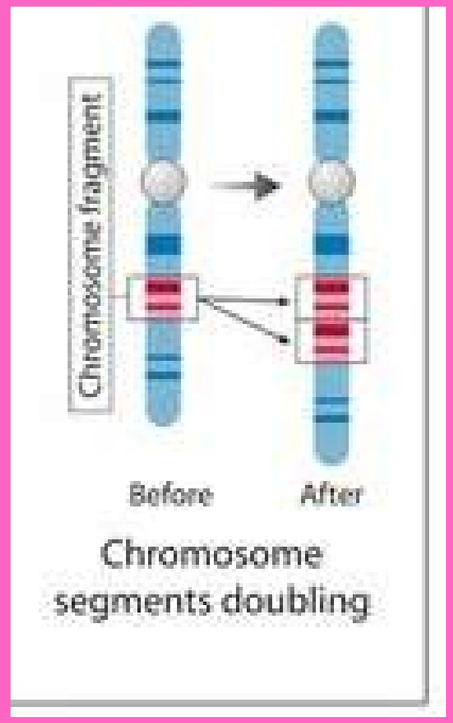
FISH test

Is there a relocation of a chromosome (translocation?



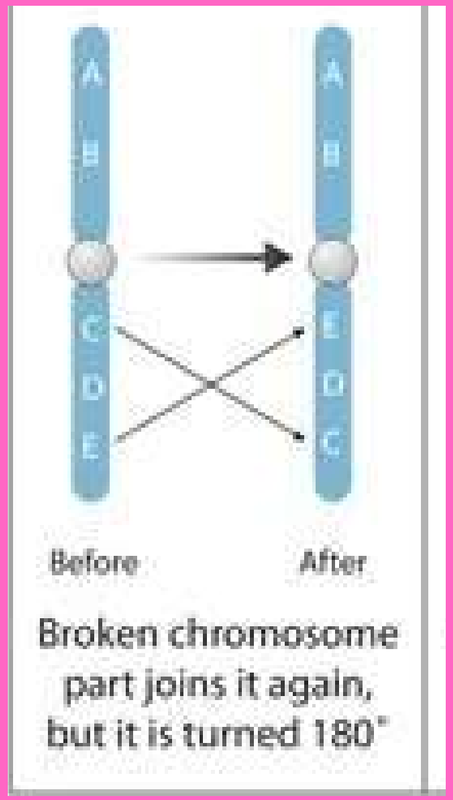
FISH test

Is there a copy or more of the chromosome (duplication)?



FISH test

Is the gene sequence inverted (reverse order)?



What is FISH used for?

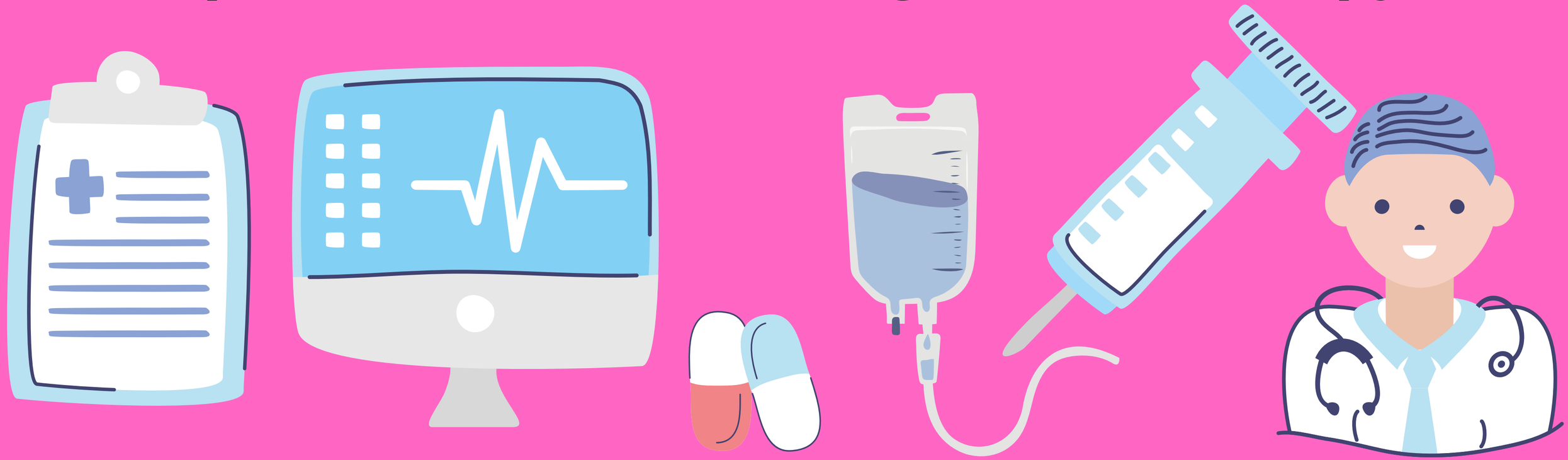
THIS HELPS DETECT CANCER!

Translocations commonly occur in sarcomas and blood cancers i.e. lymphoma and leukaemia.

Duplications commonly occurs in breast cancers.

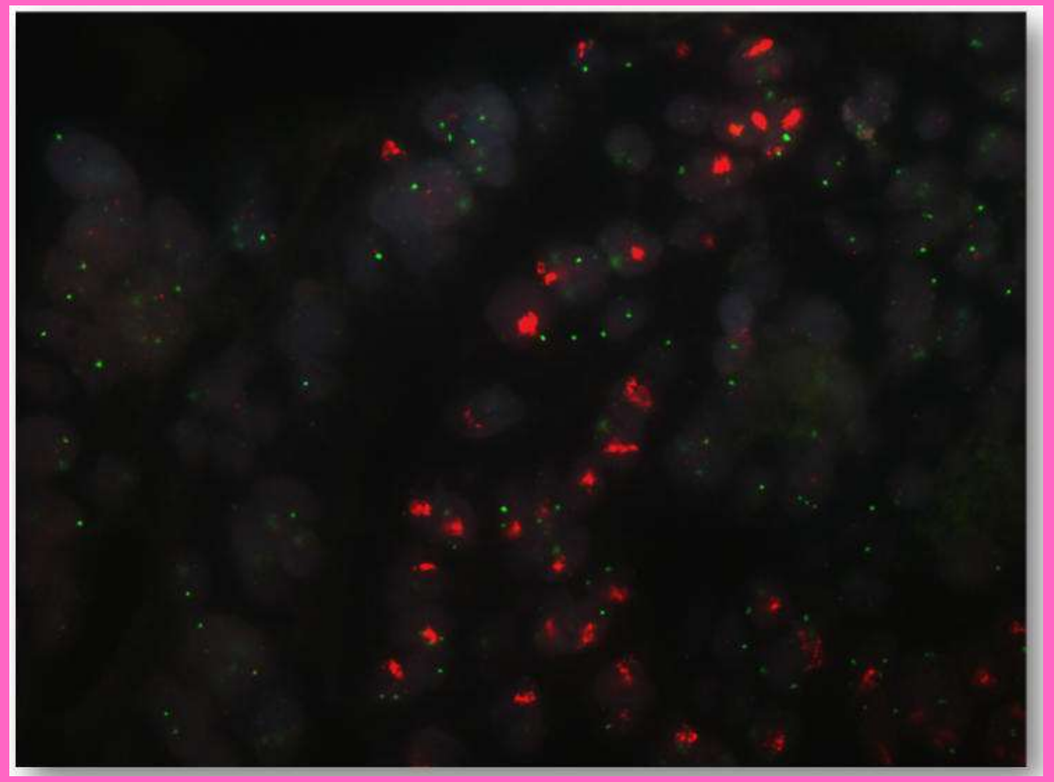
What is FISH used for?

It also helps to find the best treatment for cancer patients by finding out how well patient responds to treatment e.g. chemotherapy.



What is FISH used for?

It allows genes to be seen under microscope despite its small size.



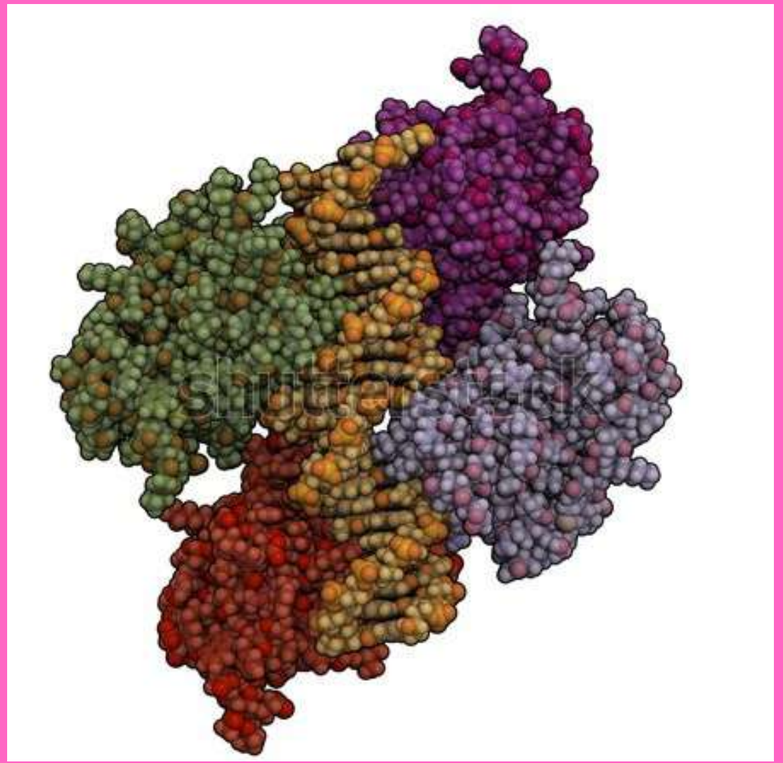
Tumour cells with HER2 gene highlighted red. (Giuseppe Viale, oncologypro.esmo.org)

What is FISH used for?

FISH can occur in cells that are dividing or not.

TP53

This is a common change in the gene and is caused when there is a deletion or missing of chromosome 17 (17p) causing a genetic change (mutation).

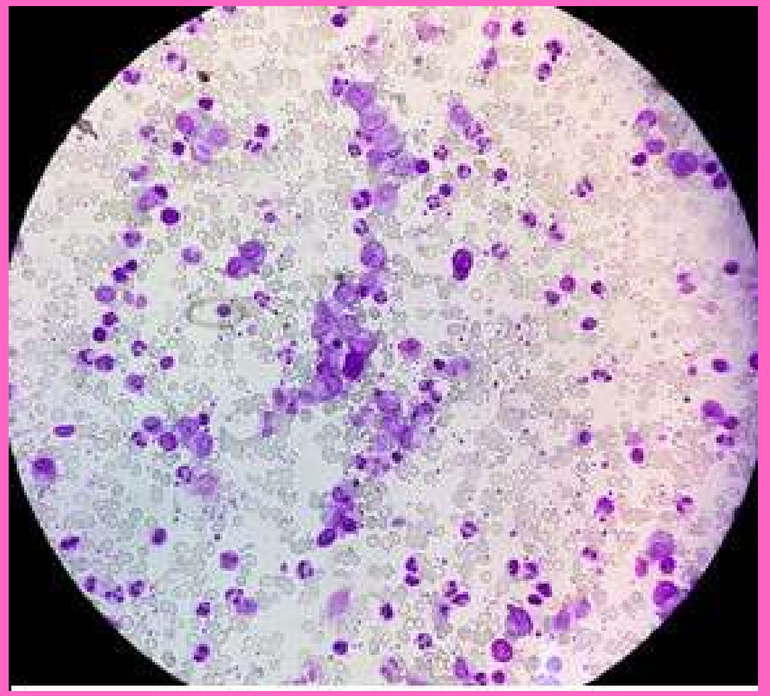


Chronic Lymphocytic Leukaemia (CLL)

It is a type of blood cancer caused by a chromosomal abnormality.

Some are linked with aggressive forms of disease that need urgent treatment.

Less aggressive forms require observation.

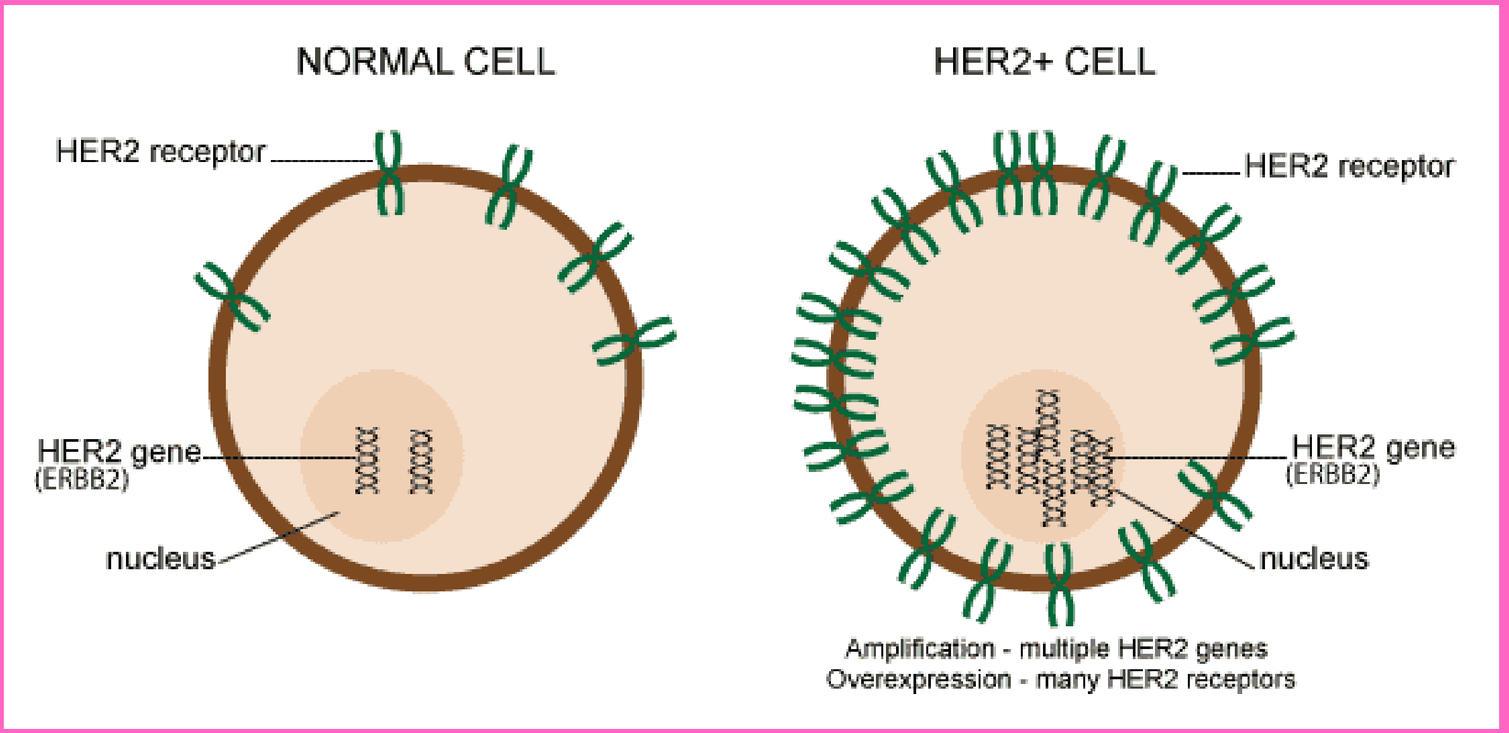


At first diagnosis, 10% of people with CLL will have a p53 gene mutation or deletion.

If the cancer comes back a p53 mutation or deletion do not respond to chemotherapy normally and targeted therapy is used.

FISH and Breast cancer

This is to see if there are extra copies of the HER2 gene which increases growth of Breast cancer cells.



FISH and Breast cancer

They are more responsive to treatment with trastuzumab (Herceptin) that blocks HER2 growth signals.

FISH and Bladder cancer

It is a reliable test to check for any abnormal cells and detect recurrence.

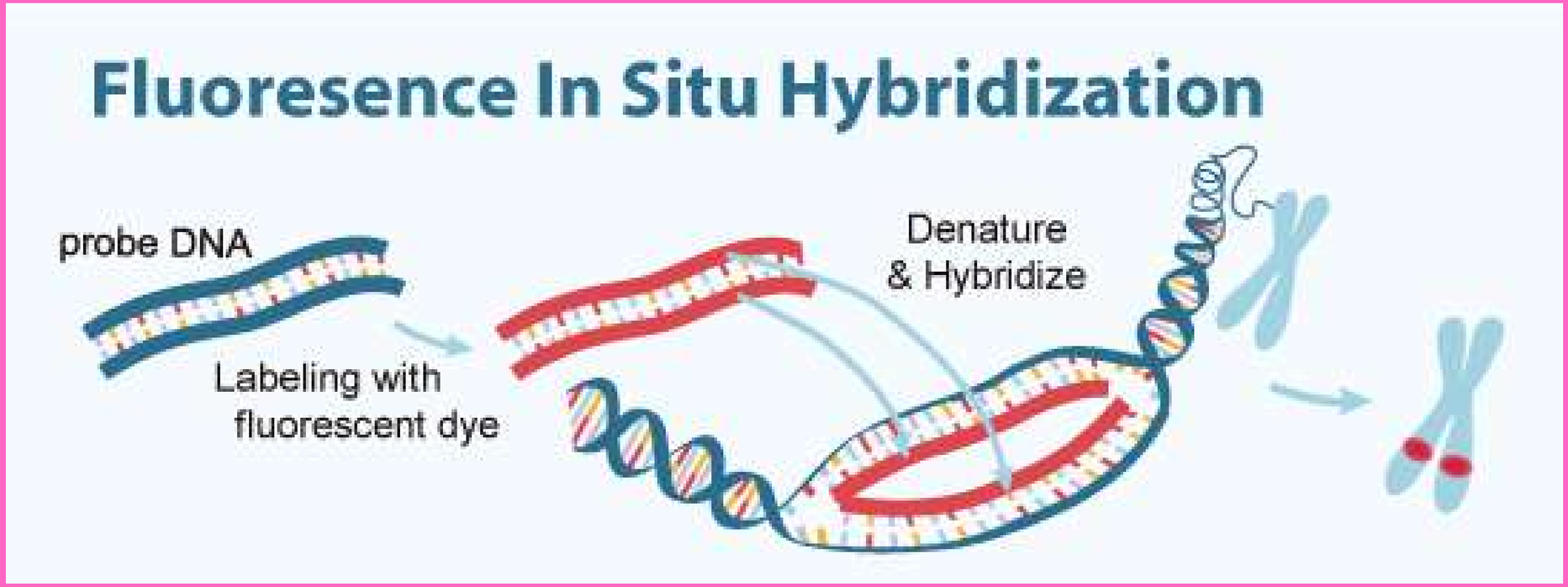
How do FISH work?

1. A tissue sample is removed and is treated with coloured dyes.

2.The dyes binds to specific areas of the chromosome.

How do FISH work?

3. The sample is then seen under the fluorescent microscope.



Urine

There are many ways urine can be used as a test.

Urinalysis

To check for blood and other substances .

Testing urine (pee) helps find infections and the diagnosis of bladder cancer.

Urine

Cytology

To look under the microscope for pre-cancer and cancer cells.

Testing urine (pee) helps find infections and the diagnosis of bladder cancer.

Urine

Urine culture

To see if there is an infection based on symptoms.

Sample is added into a dish to allow bacteria to grow if present.

Testing urine (pee) helps find infections and the diagnosis of bladder cancer.

Urine

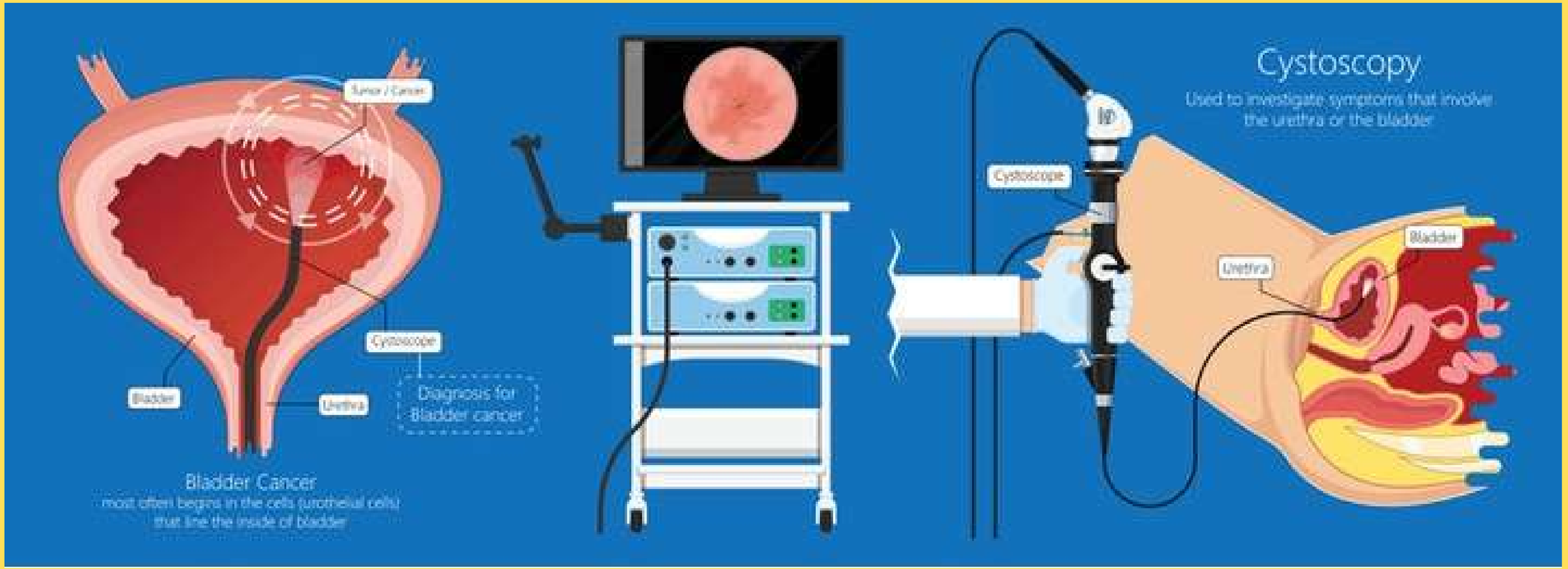
Tumour markers

There are markers for bladder cancer

e.g. NMP22 (BladderChek), BTA (STAT)

Testing urine (pee) helps find infections and the diagnosis of bladder cancer.

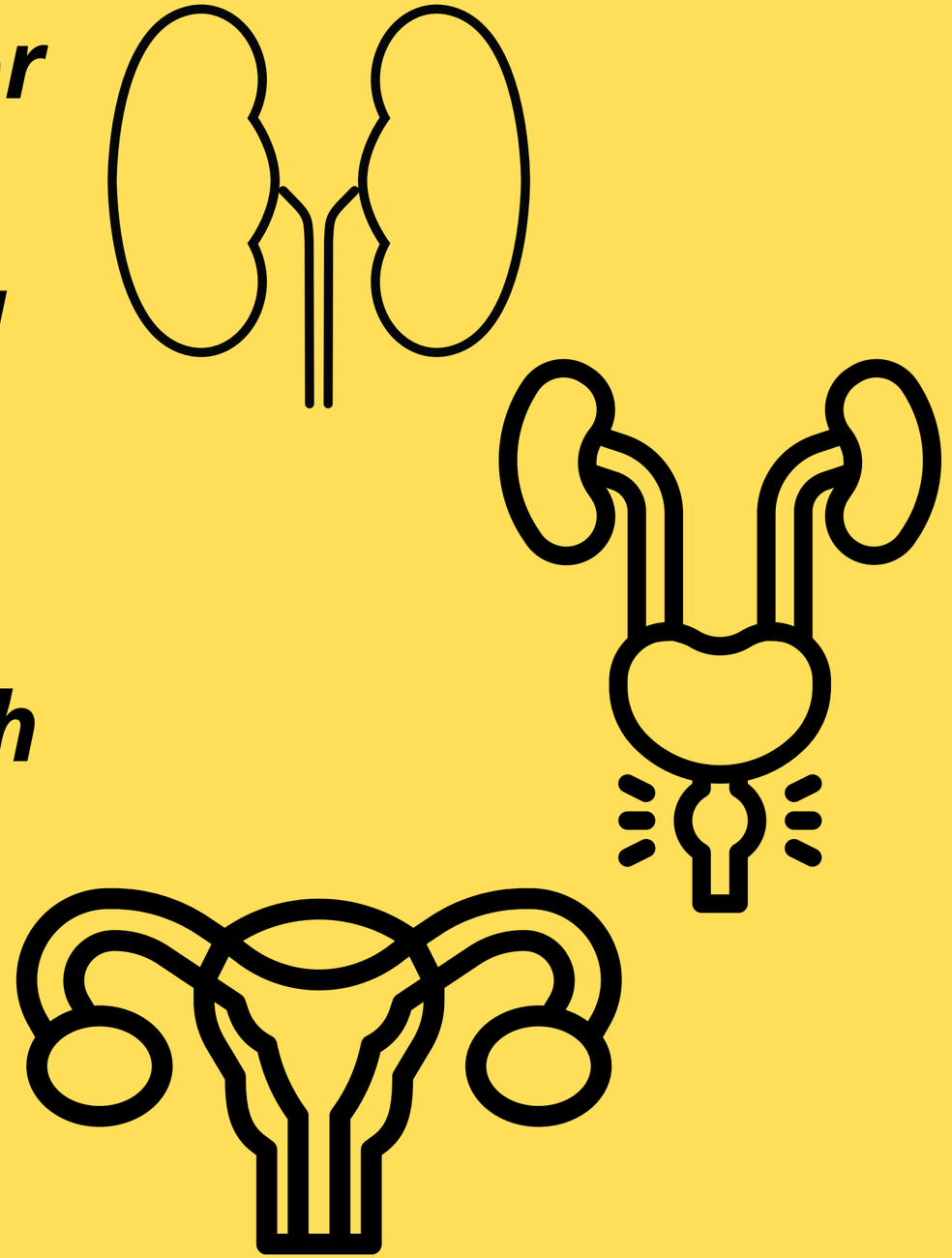
Some doctors still prefer cystoscopy than tumour markers to detect cancer cells.



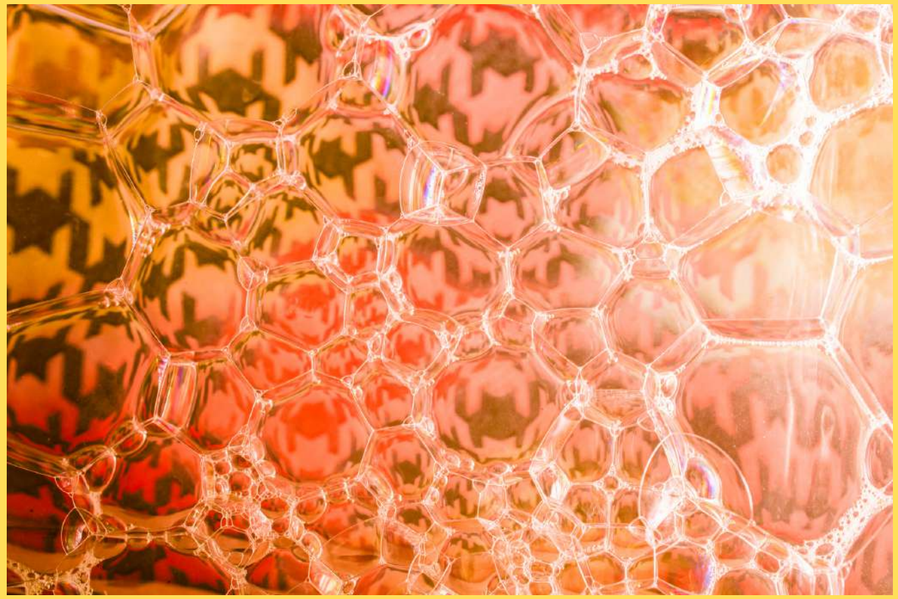
Other doctors think that tumour markers may help better when there is a relapse or recurrence of bladder cancer.

This may not only be useful for bladder cancer but also kidney, prostate and cervical cancer can get into urine.

Cancer cells can enter through the kidneys or from the bladder and ureters.



Small substances normally proteins are released by cancer cells can go to the kidneys via the blood.



BLADDER CANCER

New research on tumour biomarkers in urine.

Human papillomavirus is the main cause of cervical cancer. It can be detected in urine to detect CIN2+. (high grade cervical intraepithelial neoplasia).

This is an alternative to cervical screening.

Sargent, A, Fletcher, S, Bray, K, Kitchener, H. and Crosbie, E. (2019) Cross-sectional study of HPV testing in self-sampled urine and comparison with matched vaginal and cervical samples in women attending colposcopy for the management of abnormal cervical screening. BMJ Open 2019;9:e025388.

BLADDER CANCER

New research on tumour biomarkers in urine.

Larger substances such as DNA cannot go through kidneys and will come from the bladder. This puts them in line for further testing.

(Source: Bryan, R., Cancer Research UK)

PANCREATIC CANCER

New research on tumour biomarkers in urine.

A team from Queen Mary, University of London discovered biomarkers that can detect early stage pancreatic cancer.

(Crnogorac-Jurcevic, T., Cancer Research UK)

PANCREATIC CANCER

New research on tumour biomarkers in urine.

It initiated with the blood and progressed to urine where 40% of substances found in urine is from outside the renal or urinary system.

(Crnogorac-Jurcevic, T., Cancer Research UK)

PANCREATIC CANCER

New research on tumour biomarkers in urine.

They discovered 3 proteins that help diagnose pancreatic cancer. LYVE-1, REG1A, and TFF1 95% accuracy

Radon, T., Massat, N., Jones, R., Alrawashdeh, W., Dumartin, L., Ennis, D., Duffy, S., Kocher, H., Pereira, S., Guarner (posthumous), L., Murta-Nascimento, C., Real, F., Malats, N., Neoptolemos, J., Costello, E., Greenhalf, W., Lemoine, N. and Crnogorac-Jurcevic, T., 2015. Identification of a Three-Biomarker Panel in Urine for Early Detection of Pancreatic Adenocarcinoma. Clinical Cancer Research, 21(15), pp.3512-3521.

PANCREATIC CANCER

New research on tumour biomarkers in urine.

It is currently in clinical trials called the UroPanc study. A 4 year study that will validate these protein biomarkers with over 3,000 people.

If the clinical trial goes well, it will be a new test used by doctors.

(Crnogorac-Jurcevic, T., Cancer Research UK)

Overall, there are many tests and scans used to diagnose cancer.

Their benefits outweigh the risks and the more research done in understanding cancer, the more tests and treatments can be developed.

Understanding Cancer

A SERIES OF SIMPLE EDUCATIONAL VIDEOS FOR THE GENERAL PUBLIC

Part 19: New diagnostic techniques

UPCOMING VIDEO RELEASING SOON!

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Acknowledgements

Oxford Handbook of Oncology
MacMillan Cancer Support
Cancer Research UK
webmed.com
National Health Service
Canva
Shutterstock, dream times and Pinterest images
ramayyapramila.com
popcultureworldnews.com
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Radon, T., Massat, N., Jones, R., Alrawashdeh, W., Dumartin, L., Ennis, D., Duffy, S., Kocher, H., Pereira, S., Guarner (posthumous), L., Murta-Nascimento, C., Real, F., Malats, N., Neoptolemos, J., Costello, E., Greenhalf, W., Lemoine, N. and Crnogorac-Jurcevic, T., 2015. Identification of a Three-Biomarker Panel in Urine for Early Detection of Pancreatic Adenocarcinoma. Clinical Cancer Research, 21(15), pp.3512-3521.
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Thank you!

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