

## An Introduction to Cancer

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## Epidemiology

- 1 in 3 people will develop cancer
- 2nd most common cause of death
- Incidence increases with age
- S-E deprivation increases the risk
- Lifestyle choices are important risk factors
- Up to 70% of cancers are preventable

## What is cancer ?

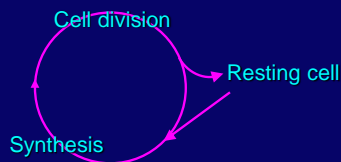
- It describes many malignant diseases
- There are over 200 types of cancer
- Changes in a cell cause the cell to grow and reproduce in an uncontrolled manner

## How does cancer arise?

- Most cancers arise from just one cell
- This cell sustains a genetic mutation
- It tends to proliferate when it should rest
- Further mutations are generated leading to a growth advantage over normal cells

## Genetic mutations cause cancer

Oncogenes and tumour suppressor genes are derived from normal cell cycle regulatory genes



## Oncogenes

- Normally act in the cell cycle to promote cell division in a controlled manner
- Mutation can alter their function to promote uncontrolled division

## Tumour suppressor genes

- Normally act in the cell cycle to downregulate cell growth and promote differentiation or programmed cell death
- Mutation can destroy this function to promote uncontrolled division

## Features of malignancy

- Primitive, undifferentiated cells
- Abnormal mitoses
- Locally invasive
- Frequently metastasise

## Pathological terms

### a glossary

## Hyperplasia

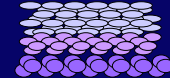
Cells appear normal but reproduce too much

Can be a normal reaction eg to hormonal stimuli or tissue damage

normal tissue



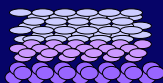
hyperplasia



## Dysplasia

Excessive proliferation of cells which appear abnormal in size shape and organisation

hyperplasia



dysplasia



## Cancer in situ

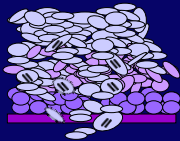
Cells carry the features of malignancy without penetrating the basement membrane. Usually will develop into invasive cancer with time



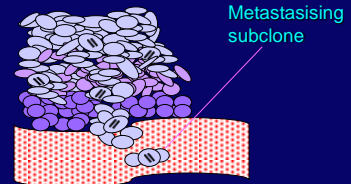
BM

## Invasive cancer

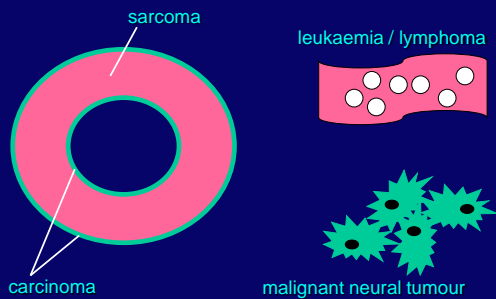
Penetrates the basement membrane



## Metastatic cancer



## Types of cancer



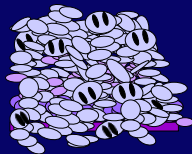
- Carcinomas - 85%  
from epithelium which lines or covers organs
- Sarcomas - 6%  
arise from connective tissues eg muscle, bone and fatty tissue
- Leukaemias / lymphomas - 5%  
occur in the bone marrow / lymphatic system
- Others - brain tumours and other rare forms of cancer

## Grade

Low grade



High grade



## Causes of Cancer

1. environment / lifestyle

- smoking
- sunlight
- diet
- alcohol
- drugs
- pollution
- medical treatment
- radiation
- occupational substances

## Causes of Cancer

### 2. infection

- Hepatitis B - liver
- Human papilloma virus - cervix
- HTLV-1 – T cell lymphoma
- Epstein-Barr virus – BL and NPC

## Causes of Cancer

### 3. inherited

- familial adenomatous polyposis
- multiple endocrine neoplasia
- retinoblastoma
- familial breast cancer  
and many more.....

## How does cancer present?

- lump/ulcer/mass
- pain
- bleeding
- cough
- obstruction
- neurological change
- weight loss
- weakness / fatigue
- anorexia
- incidental finding
- abnormal blood tests
- paraneoplastic syndromes

## How is cancer diagnosed?

- Detection of the primary tumour &/or metastases
- Histological confirmation
- Assessment of the extent of the disease (staging)

## Which cancers metastasise and where do they go?

## Metastatic spread

- some tumours rarely metastasise
  - primary brain tumours
  - BCC, mesothelioma
  - larynx
- others have often spread at diagnosis
  - lung, breast
  - prostate, colon

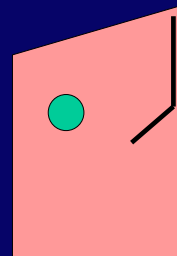
- some cancers have a preference to metastasise to certain organs
- most commonly liver, lungs, bone, brain
- lung cancer commonly spreads to adrenals and skin too
- distribution probably relates to cell surface-receptor interactions and blood flow

## Staging of cancer

T = extent of primary tumour (1-4)  
 N = spread to local lymph nodes (1-3)  
 M = distant metastases (0 or 1)

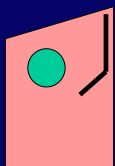
## Staging of non-small-cell lung cancer

### T stage

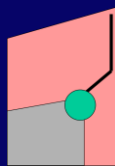


T1 ≤ 3cm

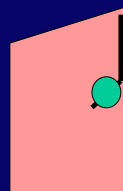
T1a ≤ 2cm  
 T1b >2cm



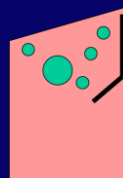
T2 - 3cm - 7cm  
 T2a 3-5cm  
 T2b 5-7cm



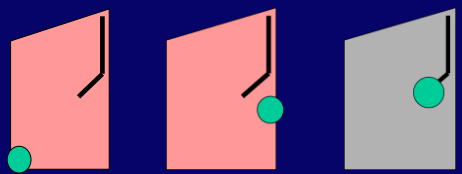
T2 – lobar obstruction



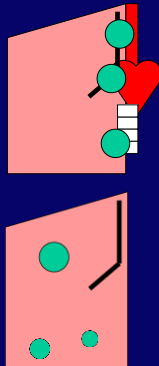
T3 <2cm from carina



T3 – multiple nodules in same lobe



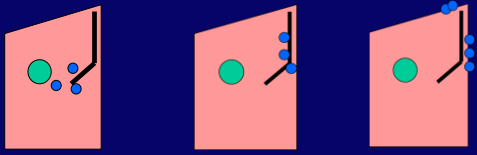
T3 – invasion of:  
chest wall  
parietal / mediastinal pleura  
complete lung collapse



T4 invades:  
heart  
great vessels  
vertebra  
trachea  
oesophagus

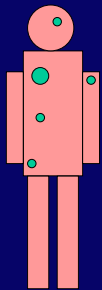
T4 – nodules in  
another ipsilateral lobe

N stage



N1                  N2                  N3

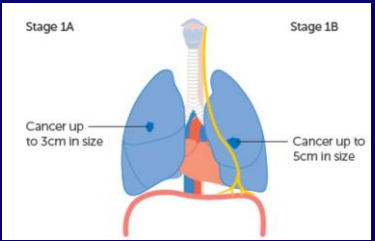
M stage



M1

Stage of lung cancer

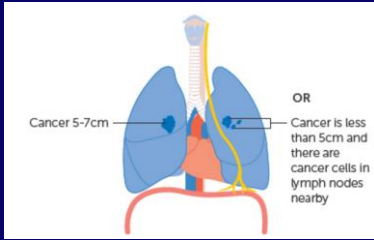
Stage 1



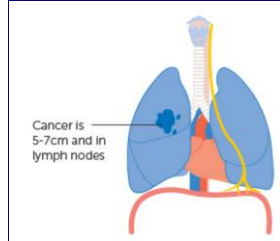
Stage 1A                  Stage 1B

Cancer up to 3cm in size                  Cancer up to 5cm in size

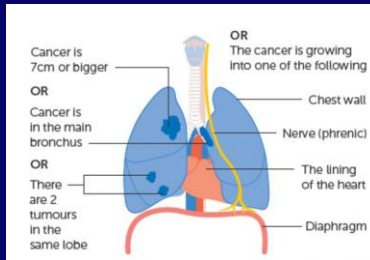
### Stage 2A



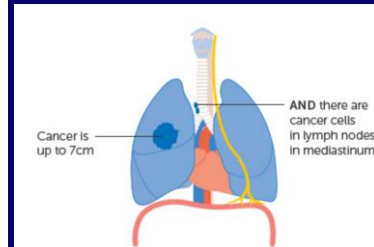
### Stage 2B



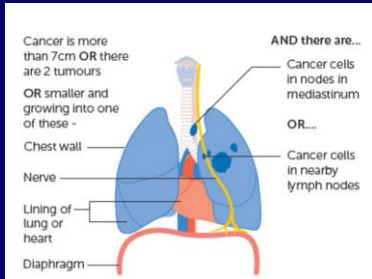
### Stage 2B



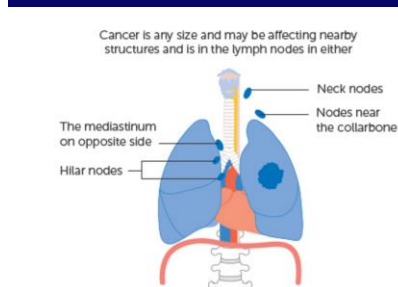
### Stage 3A



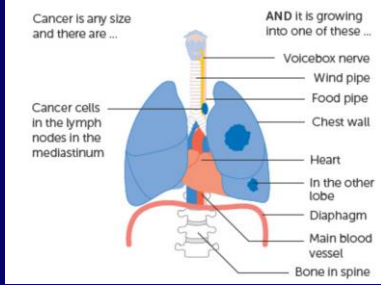
### Stage 3A



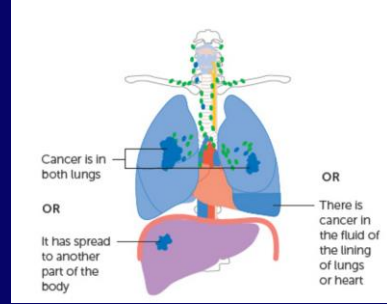
### Stage 3B



### Stage 3B



### Stage 4



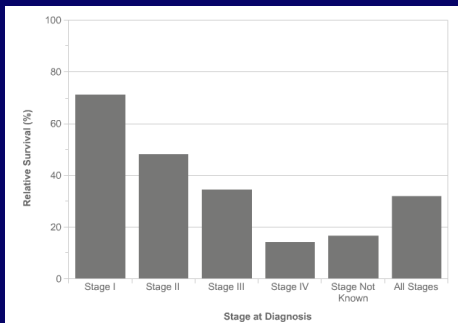
### % of cases

Stage I	14.5%
Stage II	7.3%
Stage III	31.8%
Stage IV	35.8%
Stage Not Known	10.6%
All Stages	100.0%

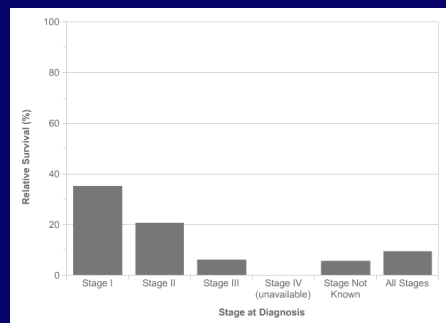
### Lung Cancer survival

		1-Year Survival (%)	5-Year Survival (%)	10-Year Survival (%)
Men	Net Survival	30.4	8.4	4.0
	95% LCL	30.1	7.5	2.8
	95% UCL	30.7	9.3	5.5
Women	Net Survival	35.1	11.6	6.5
	95% LCL	34.8	10.5	4.9
	95% UCL	35.3	12.6	8.4
Adults	Net Survival	32.1	9.5	4.9
	95% LCL	31.9	8.8	3.9
	95% UCL	32.3	10.2	6.1

### Lung cancer 1 year survival



### Lung cancer 5 year survival



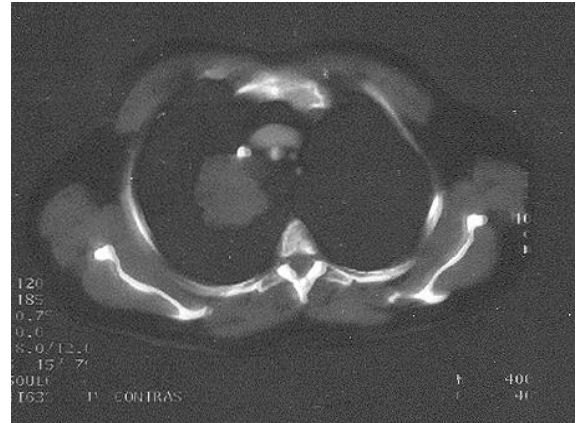
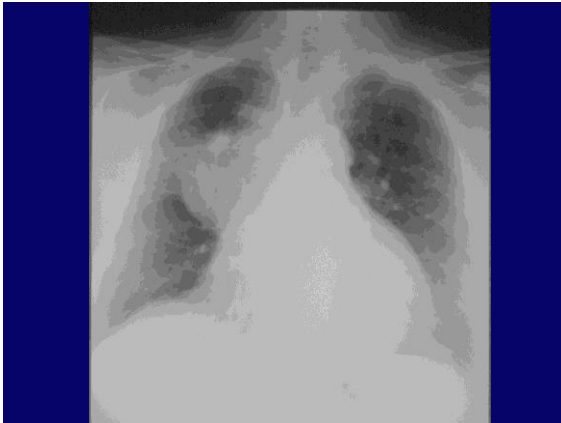


## Case

- 54 year old seaman
- smoker for 40yrs
- pain Rt upper chest for 6 months
- continues to work

## Radiological investigations

- Plain X-ray
- Contrast studies
- CT scan – cross sectional info
- MRI – anatomical / pathological info
- PET – functional info
- Bone scan – useful for bone mets



## Case

CXR and CT show right upper lobe tumour

CT shows invasion of the mediastinum and right sided mediastinal nodes

## Invasive diagnostic procedures

Allow biopsy and assessment of local extent

- EUA
- OGD
- colonoscopy
- Bronchoscopy
- EUS/EBUS
- cystoscopy
- mediastinoscopy
- laparoscopy
- excision biopsy

## Case

Biopsy shows squamous cell carcinoma of the right upper lobe invading mediastinum

## Haematological investigations

- Full blood count
- Bone marrow
- Myeloma proteins

Changes are often non-specific in common solid tumours

## Biochemical investigations

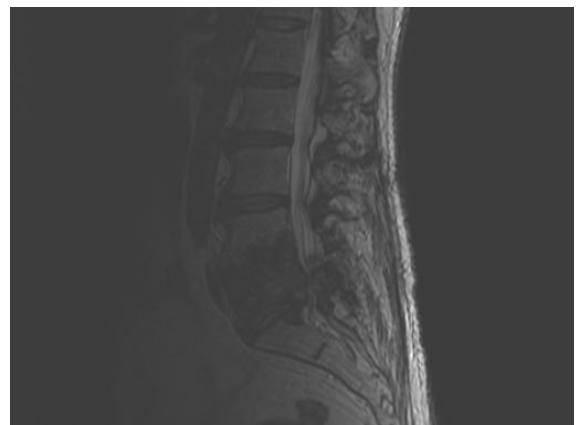
- Proteins and electrolytes
- Serum calcium
- Liver enzymes
- Tumour markers
  - PSA
  - CEA
  - CA125
  - HCG

## Case

No specific changes on blood tests

Admits to pain in lower back for 2 months gradually getting worse  
Now preventing him from working

- Plain X-ray
- Contrast studies
- CT scan – cross sectional info
- MRI – anatomical / pathological info
- PET – functional info
- Bone scan – useful for bone mets



## Case

### Squamous cell carcinoma

#### Stage

- T4 (invades mediastinum)
- N2 (ipsilateral mediastinal nodes)
- M1 (bone metastases)

## How is cancer treated?

### Conventional options

Surgery  
Radiotherapy  
Cytotoxic Chemotherapy  
Hormones

### Newer therapies

Immunotherapy  
Targeted drugs  
Gene therapy

## Radical surgery

- May provide definitive treatment
- May be diagnostic (histology and staging)
- May be combined with chemotherapy + / or radiotherapy

## Palliative Surgery

- Removal of solitary brain metastases
- Spinal surgery for SpCC
- Fixation of pathological fractures
- Bypass of bowel obstruction

## Other interventions

- Stent of SVC, ureter, oesophagus...
- Tumour embolisation
- Laser coagulation of bronchus
- Biliary drain/stent
- Pleurodesis
- Drainage of fluid collections