Incidental Findings on MRI Scans

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THIS IS MODERN MEDICINE

Introduction

- Incidental findings (aka incidentoma)
    - unexpected health-related discovery made during a medical test, scan (like CT or MRI), or research.
    - Revealing an unrelated condition, growth, or risk factor, sometimes benign but potentially significant enough to warrant further investigation and treatment.
- Increase in MRI access and Imaging quality
- Incidental findings can be a source of anxiety for patients (and ordering doctor)
    - Can range from normal anatomic variants to serious pathologies
    - There can be treatment or follow-up dilemmas
    - Involves potential economic consequences for patient and healthcare systems
        - costs for follow-up, insurance/financial implications, and decisions on sharing results.
    - Need for clear communication the patient

Characterization

1. Neoplastic
    - Meningioma/schwannoma
    - Glioma/Glioneuronal tumours
    - Pituitary adenomas
2. Cystic
    - Pineal cysts
    - Arachnoid cysts
    - Colloid cysts
    - Rathkes cleft cyst
3. Vascular
    - Cavernomas
    - Aneurysms
    - AVMs
    - Old infractions/Non-specific white matter changes
    - Dural AV fistulas
4. CSF Circulation-Ventricular size
    - Chiari 1 Malformation
    - Ventriculomegaly vs hydrocephalus
5. Congenital/anatomic variants
    - Cavum septum pellucidum, cavum et vergae, velum interpositum
    - Gray matter heterotopia
    - Mega cisterna magna
    - Vascular anatomy variants

1. Neoplastic

Meningioma's

- Derived from the meninges-Arachnoid cap cell (mesenchymal progenitors), dura lineage
- Grades 1-3
- Grade 1 is benign slow growing (~80-90%)(~1% risk of malignant transformation)
    - Meningothelial, Fibrous, Transitional, Pssammomatous, Angiomatous, Microcystic, Secretory etc
- Grade 2: Atypical intermediate growth rate (5-25%), increased mitosis (4-19 per 10 HPF), or at least 3 of 5 features: increased cellularity, sheet-like growth, small cells, macronucleoli, or necrosis. Presence of brain invasion
    - Chordoid, clear cell
- Grade 3: Anaplastic/Malignant fast growing and aggressive (1-2%) increased mitosis (>20 per10 HPF), TERT promoter mutations, CDKN2A/B homozygous deletions, or sometimes H3K27me3 loss
    - Papillary, rhabdoid

1. Neoplastic

Meningioma's-follow-up , discharge or treat?

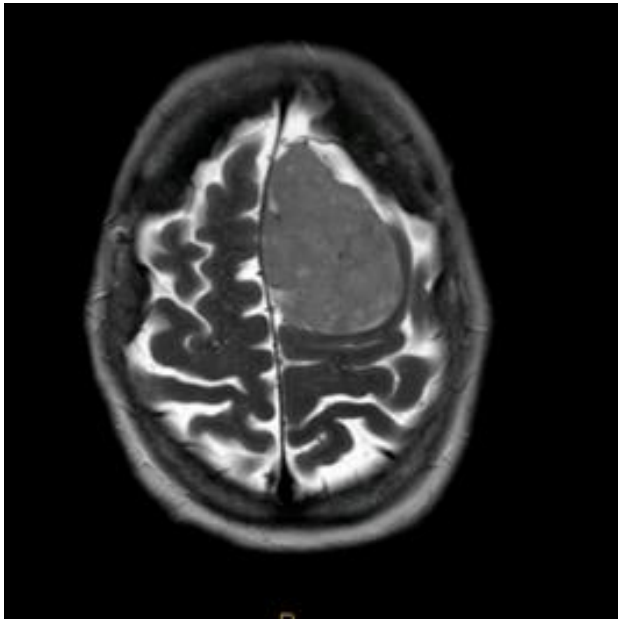
- Age
- Size
- Location
- Soft tissue vs Calcifications
- Reaction of brain parenchyma

Treatment options available

- Surgical- Craniotomy
- Radiotherapy
    - Stereotactic Radiosurgery,<3cm 15Gy/1
    - Fractionated Stereotactic radiosurgery
    - Intensity-modulated radiation therapy
- Radiological follow

Can discharge some after counselling

- Elderly, small, convexity and heavily calcified



1. Neoplastic

Glioma/Glioneuronal tumors

Gliomas

- Derived from the glial support cells, astrocytes, oligodendrocytes, ependymal
- WHO classification 2021- integrated diagnosis
    - Glioma-IDH mutant vs GBM IDH wildtype
    - Oligodendroglioma- 1p/19q codeletion, IDH mutation
        - Grade 2- essential the absence of Anaplasia
        - Grade 3- increased mitotic activity, microvascular proliferation, Necrosis

1. Neoplastic

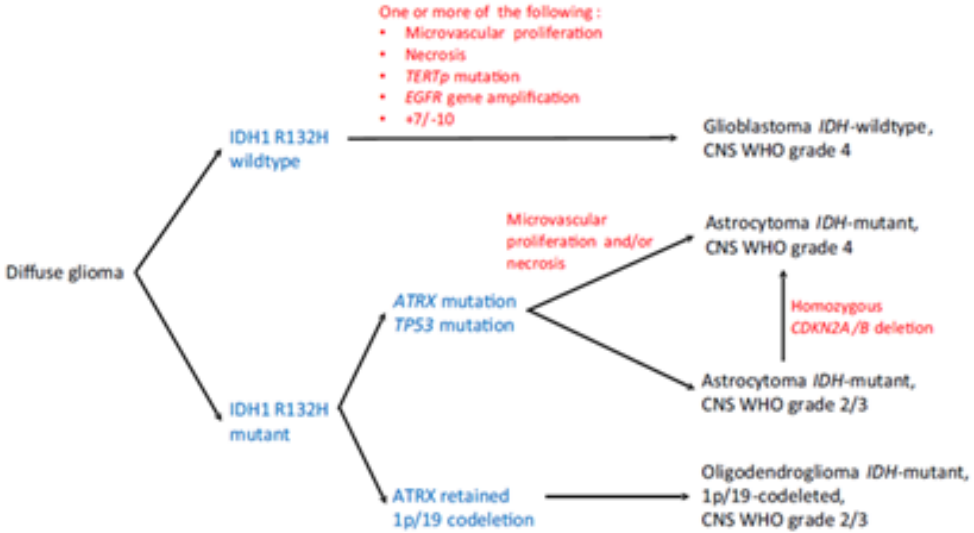
Glioma-Continued

Astrocytoma –IDH mutant,ATRX mutant

- Grades 1- pilocytic astrocytoma. Generally slow-growing and non-infiltrating (e.g., Pilocytic Astrocytoma). Often considered "benign" because they can frequently be cured by surgery alone.
- Grade 2 - Infiltrating (diffuse) tumors with nuclear atypia but no mitoses, necrosis, or microvascular proliferation. They lack the CDKN2A/B deletion.
- Grade 3 - Characterized by increased cellularity and significant mitotic activity (anaplasia). They lack necrosis and microvascular proliferation.
- Grade 4 - Presence of necrosis or microvascular proliferation, CDKN2A/B homozygous deletion

1. Neoplastic

- Glioblastoma
  - Astrocytic
  - IDH wildtype
  - Microvascular proliferation
  - Necrosis
  - TERT p Mutation
  - EGFR amplicfation
  - +7/-10



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1. Neoplastic

Glioneuronal tumors- often benign and slow-growing, originating from neural precursor cells, containing a mix of nerve cells and glial cells, often associated with epilepsy

- DNET, Gangliogliomа, Central neurocytoma, Multinodular and vacuolating neuronal tumour, Gangliocytoma etc
- Benign Grade 1
- Risk of malignant transformation is dependent of type and ranges for ,<1% to 14.5%

1. Neoplastic

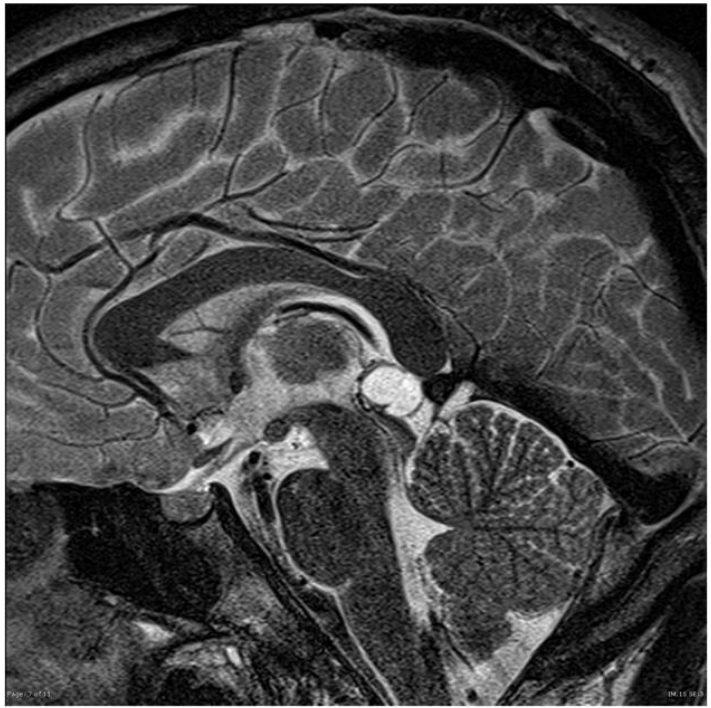
Follow-up, discharge or treat?

- Radiological characteristics and level of confidence in radiological DDX
- Anatomic and functional location
- Age of patient

    - In general- gliomas should be treated early
        - Maximum safe resection
        - Adjuvant treatment depends of several factors
    - Glioneuronal tumour
        - Nuanced discussion

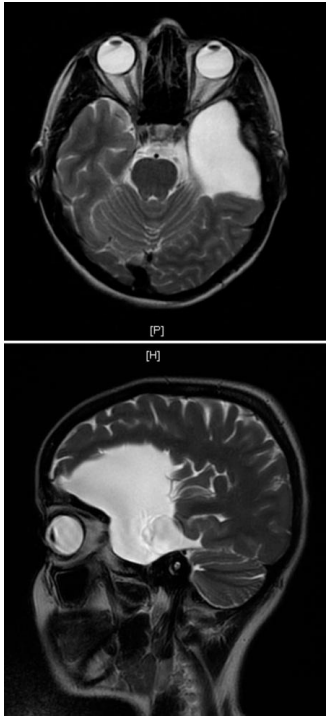
2. Cystic lesions

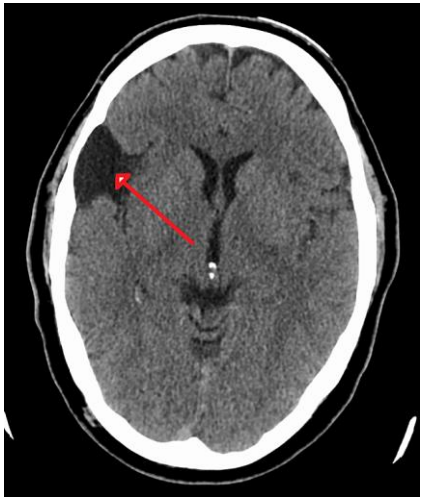
- Pineal Cyst
  - Commonly found on MRIs
  - Largely stable-some natural history series demonstrate growth in younger age groups
  - Radiology
    - Distortion of aquaduct/hyrdrocephalus
    - Irregular/thick enhancement
    - Large
    - Evidence of haemorrhage (apoplexy)



2. Cystic lesions

- Arachnoid cysts
  - Common
  - originate from a split or duplication in the arachnoid membrane (congenital), rarely d/t trauma, infections
  - Congenital are stable in adults
  - Large convexity cysts have a small risk of rupture





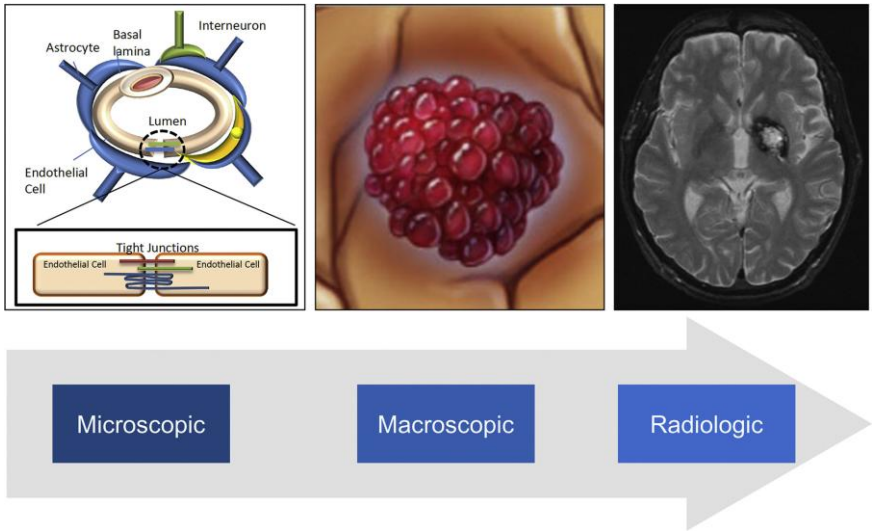
2. Cystic lesions

Follow-up, discharge or treat?

- Depending of radiological features
    - Any complex features?
- Usually able to counsel patient on signs and symptoms to watch out for and discharge- especially small pineal cysts in adults and practically all arachnoid cysts (assuming all correct MRI sequences are performed).

3. Vascular

- Cavernomas
  - cluster of abnormal, thin-walled blood vessels, often resembling a raspberry,
- **No prior bleed:** Less than 1% to 2.4% annual risk of a first symptomatic bleed.
- **After a first bleed:** 4% to 29.5% annual risk of re-bleeding, peaking in the first few years.
- **Seizures:** 50% of patients with cavernomas will have a seizure with high risk of developing recurrent seizures/epilpesy



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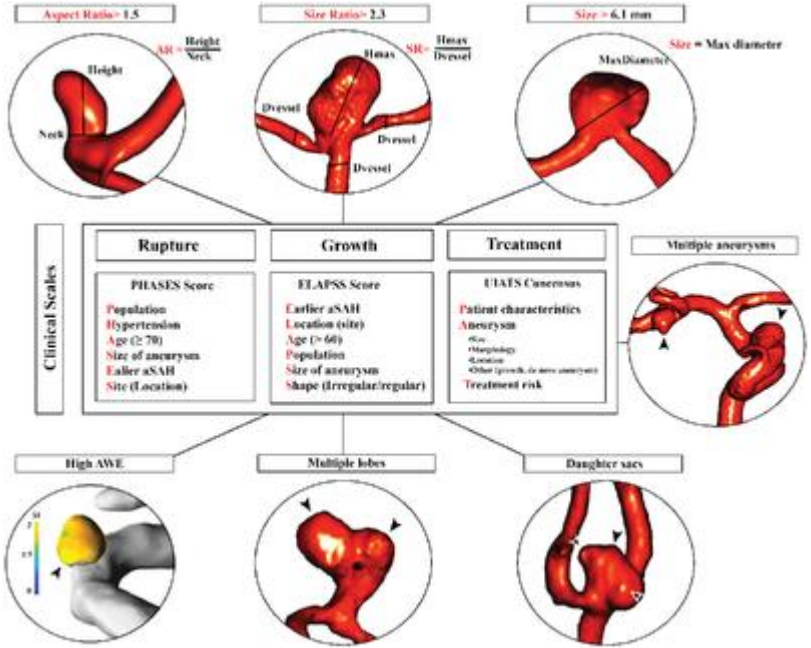
3. Vascular

- Aneurysms
  - an abnormal, permanent localized dilation of an artery typically caused by weakening of the **tunica media**
  - Risk of rupture:
    - Size, location, shape,
    - Family history, past medical history (HTN, DM, atherscloerosis), smoking
- emerging evidence questions the validity of a size-based treatment paradigm. Small aneurysms (≤5 mm) are implicated in up to 51 % of aneurysmal subarachnoid haemorrhages (aSAH), challenging the assumption of benignity for these lesions



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3. Vascular

Follow-up, discharge or treat?

Cavernomas
Incidental- counsel and follow-up
Indications for treatment via surgery

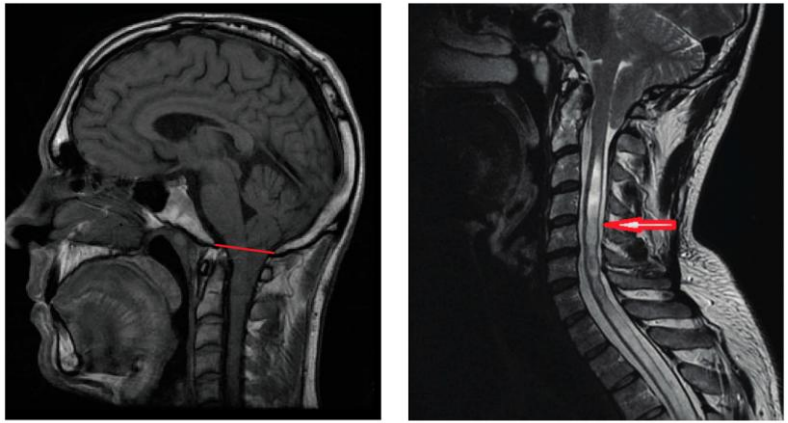
- Recurrent haemorrhage
- Seizure

Aneurysms

- Several factors including annual risk of rupture, age versus risk of treatment
- Vast majority will require treatment or follow-up
- Treatment options
  Craniotomy and clipping
  Endovascular treatment

4. CSF Circulation

- Chiari 1 Malformation
  - Herniation of the cerebellum through the foramen magnum
  - Radiologically defined by >5mm
  - Can result in impairment of CSF flow across the CCJ
  - Associations
    - Skull base angle, post fossa lesions, hydrocephalus, scoliosis, syringomyelia, Tethered Cord Syndrome



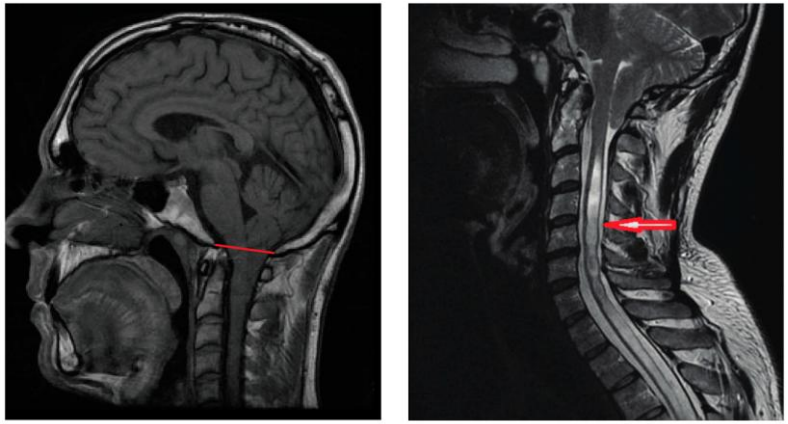
(a) (b)

4. CSF Circulation

- Chiari 1 Malformation

When symptoms occur, they may include:

  - Headaches: Severe pressure-like pain at the back of the head, often triggered by coughing, sneezing, or straining.
  - Neck Pain: Persistent aching in the neck and upper shoulders.
  - Balance & Coordination Issues: Dizziness, an unsteady walk, or trouble with fine motor skills.
  - Sensory Changes: Numbness or tingling in the hands and feet.
  - Other Symptoms: Difficulty swallowing, hoarseness, blurred vision, and sleep apnea



(a) (b)

4. CSF Circulation

- Chiari 1 Malformation
  - Follow-up, discharge or treat?

- If truly incidental finding- i.e. scan for head trauma and no concerning radiological features then can discharge with advice
- If associated with headaches only and simple Chiari – depending on headache phenotype, severity- f/u or treatment are options
- If complex- i.e. syrinx, papilledema, scolosis, etc treatment>follow up
  - Surgical treatment involves craniocervical decompression
    - With or without duraplasty

5. Congenital/anatomic variants

- Cavum septum pellucidum, cavum et vergae, velum interpositum
- Ventricular asymmetry
- Mega cisterna magna
- Developmental venous anomalies
- Vascular variants
    - Anatomical variations in intracranial arterial anatomy include:
        - Fenestrations
        - duplications
        - persistent fetal arteries
- Follow-up, discharge or treat?

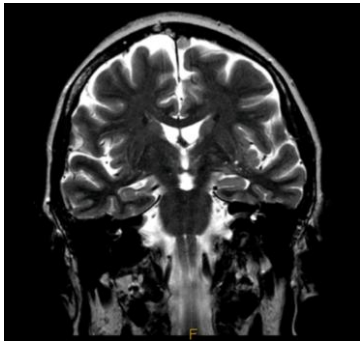
  Can be safely discharged

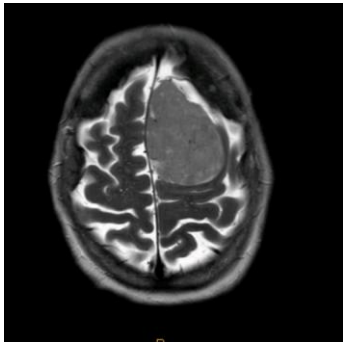
Case Examples

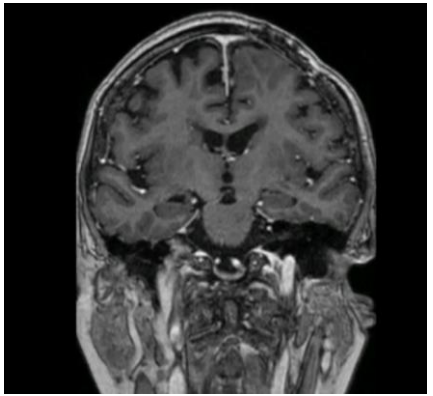
verbal consent obtained

Case example -1

- Mrs AG- 76 yr RHD
  - PMedHx- HTN-poor control
- Had MRI due ongoing headaches.
- Previously had MRI for same indication 15yrs prior
- Uneventful Simpson 2 resection
  - Some minor perioperative BP control issues
- MRI surveillance one year post-op

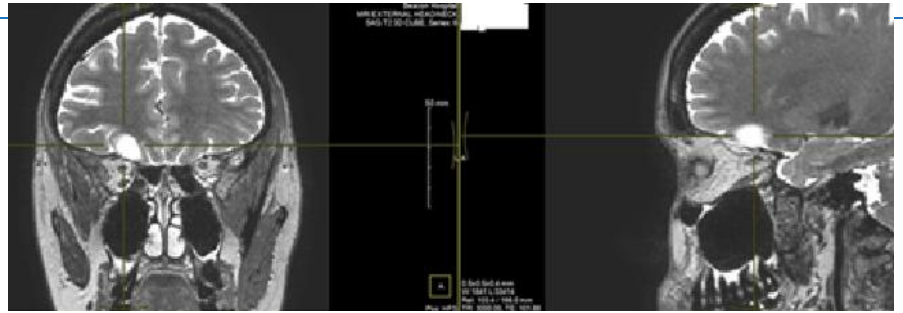


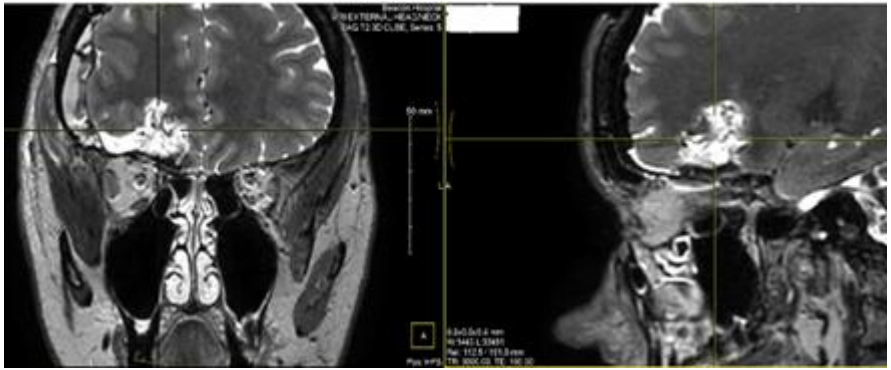




Case example - 2

- Ms EK -45 yr right hand dominant
- No past medical history
- Strong Family history of systemic cancer
- Visiting New York had whole body MRI
    - No systemic concern
    - MRI of her neck caught a glimpse of a intracranial lesion
    - Returned home and organized a MRI brain
- Uneventful Gross total resection
- Currently half through Adjuvant chemotherapy and radiotherapy





Thank you

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