



Radiology Team

Nuclear Medicine Interactive Lecture

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Check the correction file please:

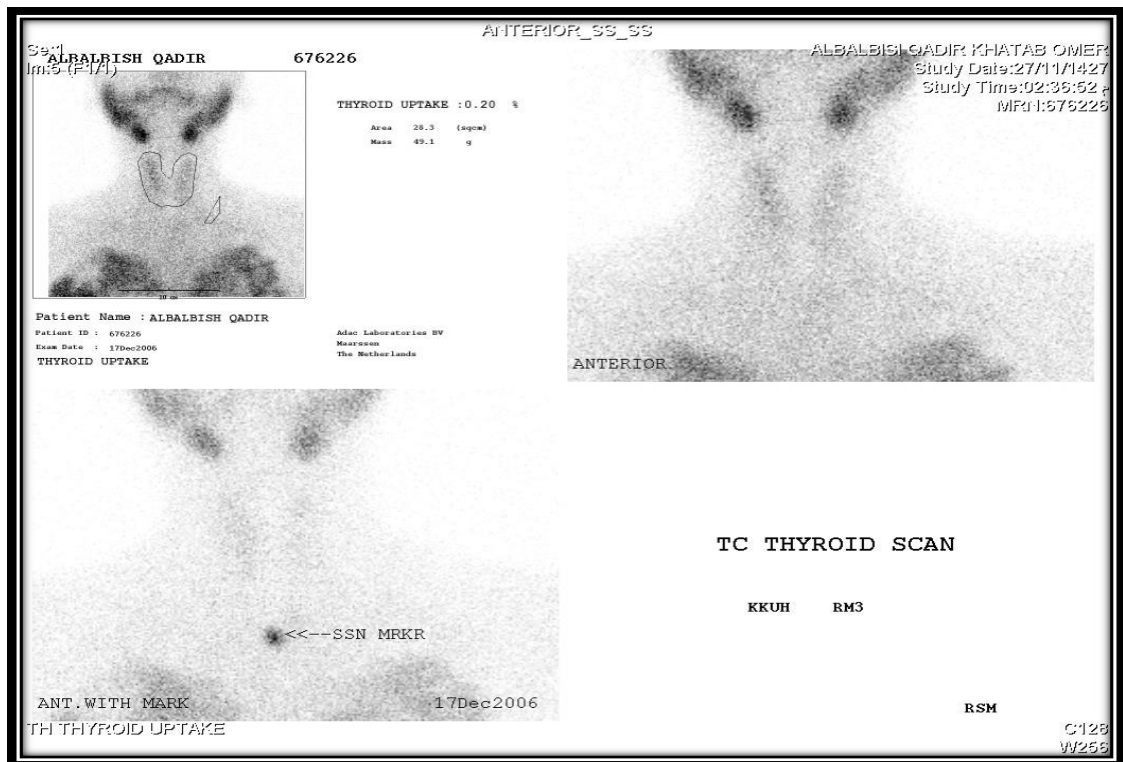
<http://goo.gl/I2TzAL>



Color Index:

• Important • Females' notes • Males' notes • Explanations

Elevated T4 and suppressed TSH



What is the study?

Nuclear scan of the thyroid

What is the agent used?

Tc-99m Pertechnetate.

What are the imaging findings?

Decreased uptake in both lobes 0.20% (Normal 0.5%-4%)

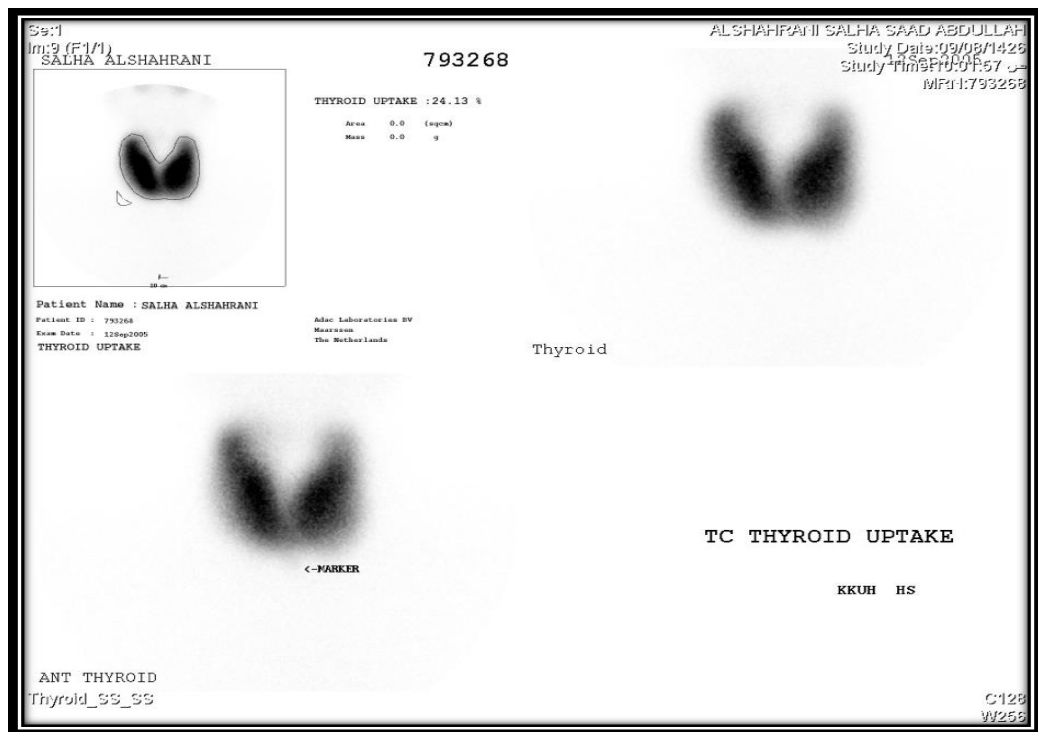
What is the most likely diagnosis?

Thyroiditis.

What is the treatment ?

symptomatic treatment give beta blockers .

Elevated T4 and suppressed TSH



What is the study?

Nuclear scan of the thyroid.

What is the agent used?

Tc-99m Pertechnetate.

What are the imaging findings?

Bilateral diffused uptake 24.13% (Normal 0.5%-4%)
hot nodule

What is the most likely diagnosis?

Graves disease.

What is the treatment?

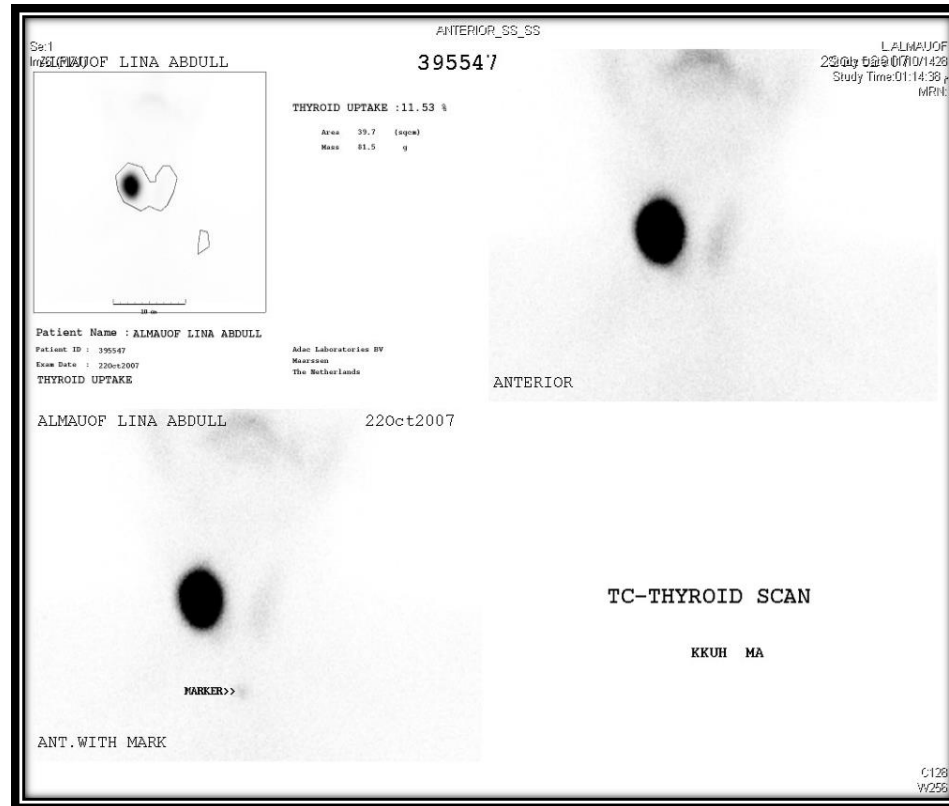
Need definitive treatment (3 modalities) :

1- medical (symptomatic)

2- surgical if there is compression symptom

3- Iodine (131) radiological

Elevated T4 and suppressed TSH



Prognosis:

- Hot nodule: <5%
- Cold nodule:
(15%-20%).

What is the study?

Nuclear scan of the thyroid.

What is the agent used?

Tc-99m Pertechnetate.

What are the imaging findings?

Hot nodule on the right lobe suppressing the left Elevated uptake 11.53% (Normal 0.5%-4%)

What is the most likely diagnosis?

Autonomous toxic nodule .

What is the treatment ?

Treat nodule :

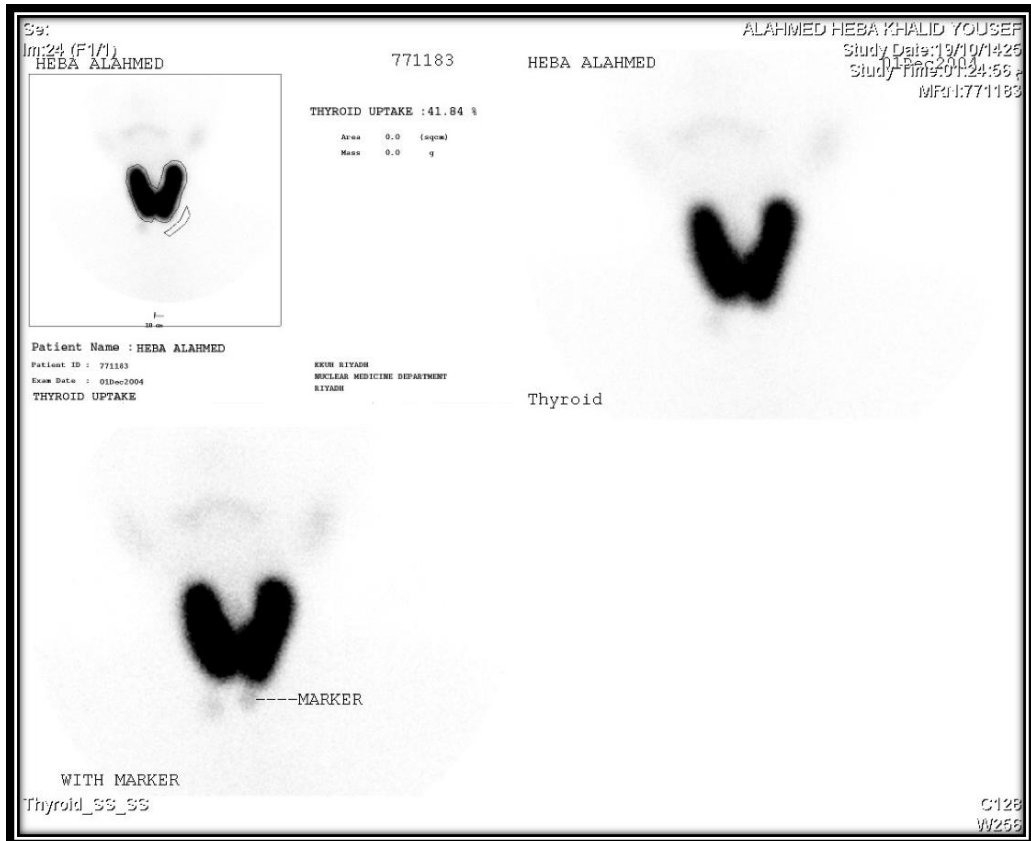
1st option : remove it

2nd option : RAI

What is the chances of this nodule of being malignant?

Low chance of being malignant < 5%

Elevated TSH and low T4 (2 YEARS OLD)



What is the study?

Nuclear scan of the thyroid (for a child).

What is the agent used?

Tc-99m Pertechnetate.

What are the imaging findings?

Diffuse uptake Enlarge gland (goiter)

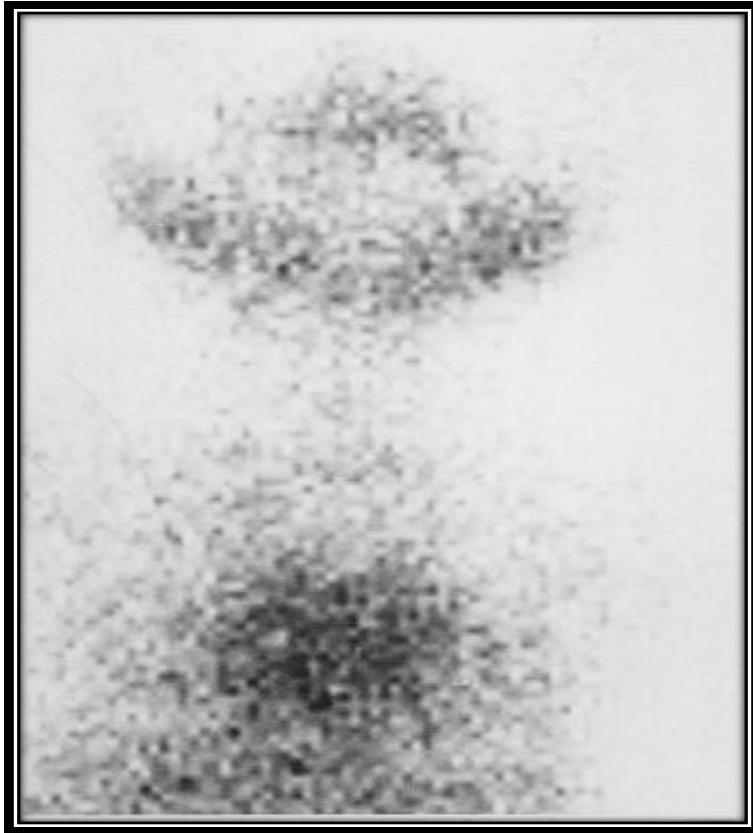
What is the most likely diagnosis?

Dyshormonogenesis

Dyshormonogenesis is Genetic defects in the synthesis of thyroid hormones.

Patient will have hypothyroidism ,goiter, increase uptake, elevated TSH and low T4

Elevated TSH and low T4



What is the study?

Nuclear scan of the thyroid (for a child/new borne).

What is the agent used?

Tc-99m Pertechnetate .

What are the imaging findings?

Absence of thyroid gland .

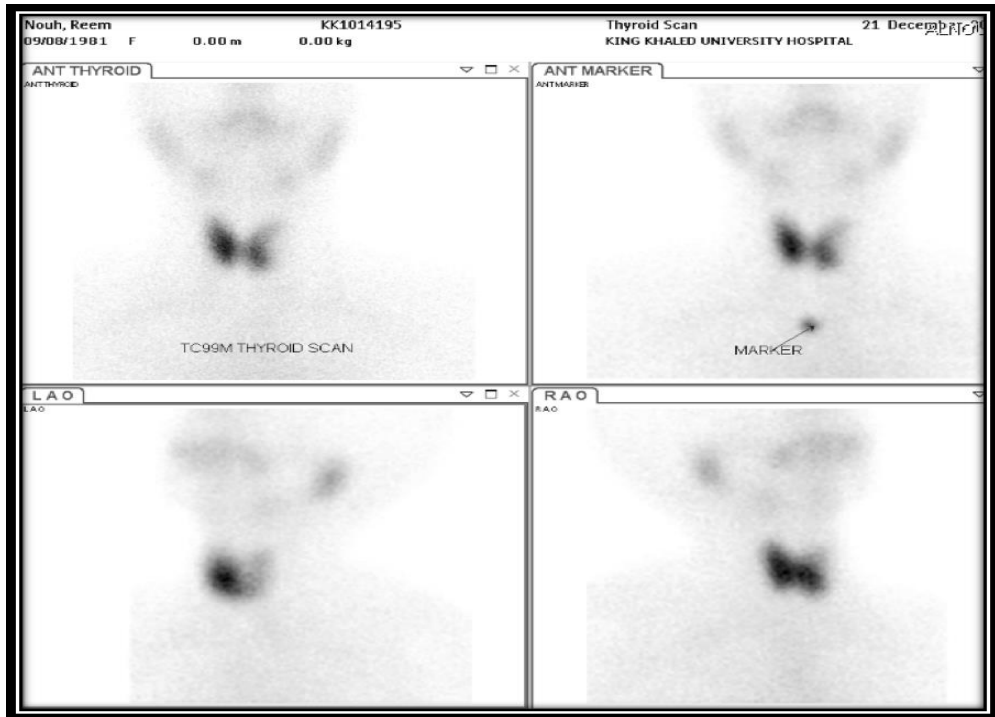
What is the most likely diagnosis?

Agenesis .

What is the treatment ?

Thyroxin whole life.

Palpable Neck Mass



What is the study?

Nuclear scan of the thyroid .

What is the agent used?

Tc-99m Pertechnetate .

What are the imaging findings?

Solitary Cold nodule(White)in the left thyroid lobe.

What is the most likely diagnosis?

Thyroid cancer .

What are the chance of this nodule to be malignant?

15%-20% cold nodule

What is the next step ?

FNA and if turns malignant next step is surgery to remove it .

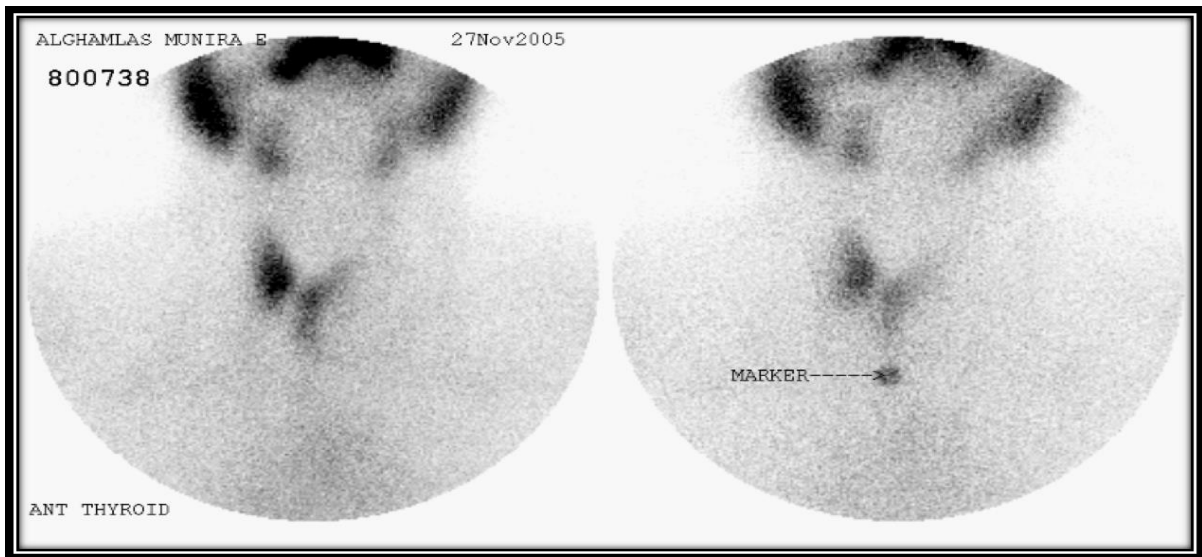
Papillary carcinoma : Spread locally by lymphatic

> good prognosis

Follicular carcinoma : Spread distant by blood to bone brain lung

> bad prognosis

Palpable Neck Mass



What is the study?

Nuclear scan of the thyroid .

What is the agent used?

Tc-99m Pertechnetate .

What are the imaging findings?

Decrease uptake in left upper thyroid lobe(Cold nodule).

mass in left lobe push the thyroid to right

marker is useful here to tell if there is tracheal shift.

What is the most likely diagnosis?

Mass on the left side pushing the gland laterally

What are the chance of this nodule to be malignant?

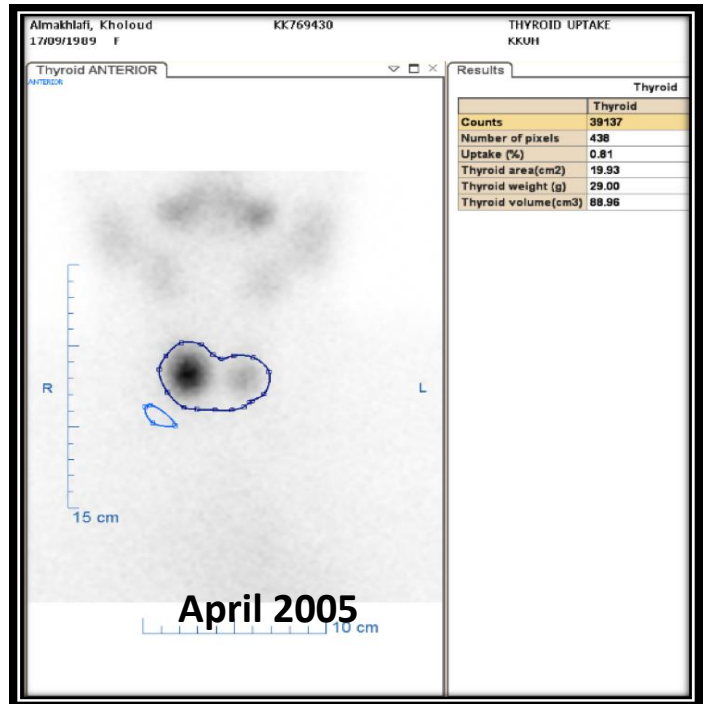
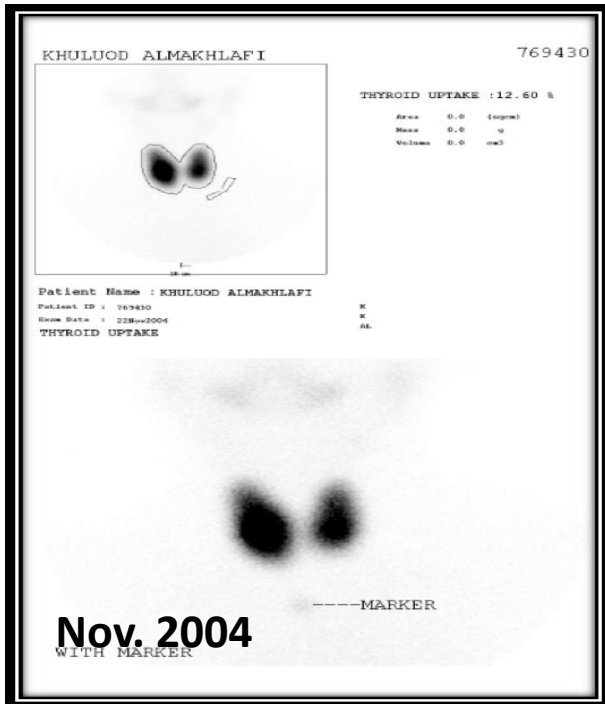
15%-20%

patient may present clinically with ?

May present with airway symptom dyspnea because thyroid set on trachea

What is the treatment ?

FNA and if turns malignant next step is surgery to remove it



What is the study?

Nuclear scan of the thyroid .

What is the agent used?

Tc-99m Pertechnetate .

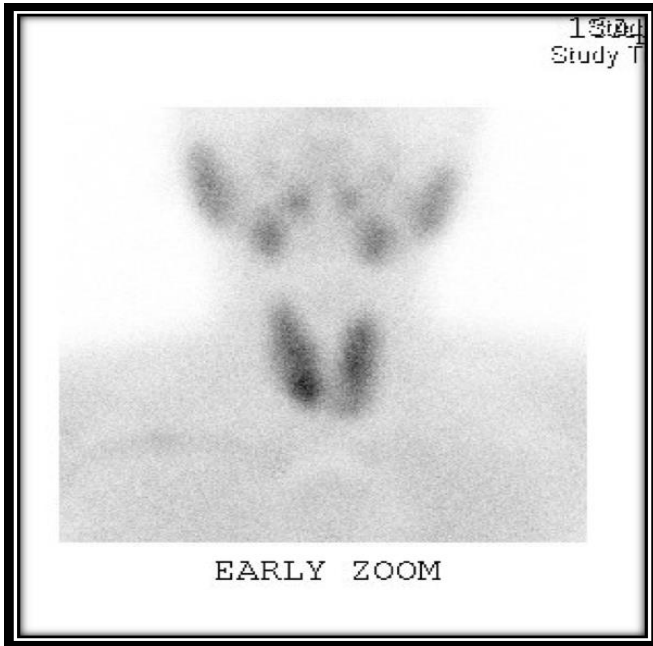
What are the imaging findings?

increase uptake 12,6% in (november 2004) patient receive treatment and has good response in (april 2005) take another image found to be decrease in uptake with 0.81%

What is the most likely diagnosis ?

what is the type of treatment he receive ?

High PTH and High Ca



both glands (thyroid and parathyroid) uptake agent

there is a delay uptake in right lower lobe of parathyroid while normally there isn't delay

What is the study?

Parathyroid scan.

What is the agent used?

Tc-99m Sestamibi (Dual Phase).

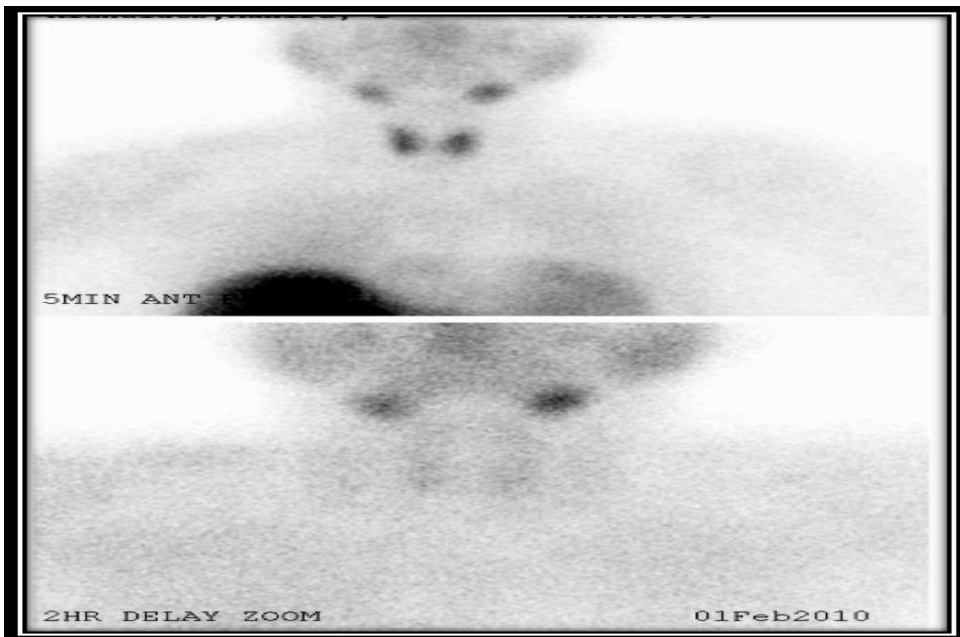
What are the imaging findings?

Right lower parathyroid adenoma.

What is the most likely diagnosis?

Parathyroid adenoma

High PTH and High Ca



Sestamibi is taken up by **mitochondria** in parathyroid

Chief cell

There is **no mitochondria** and it doesn't take up **Sestamibi** so it gives a **false** negative

Exophilic cell

Rich in mitochondria and it takes up **Sestamibi** so it gives a **true** parathyroid adenoma

In this case because of laboratory tests are (+) and we assume that the patient did not take exogenous therapy we suspect **Parathyroid adenoma** and we will do MRI

What is the study?

Parathyroid scan.

What is the agent used?

Tc-99m Sestamibi (Dual Phase).

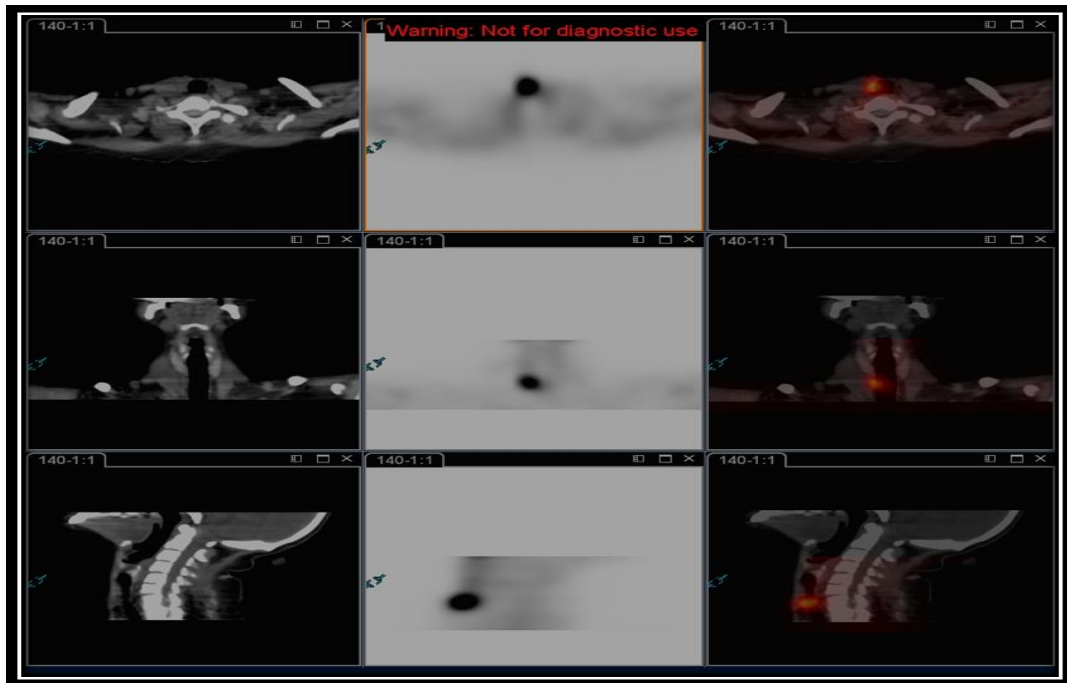
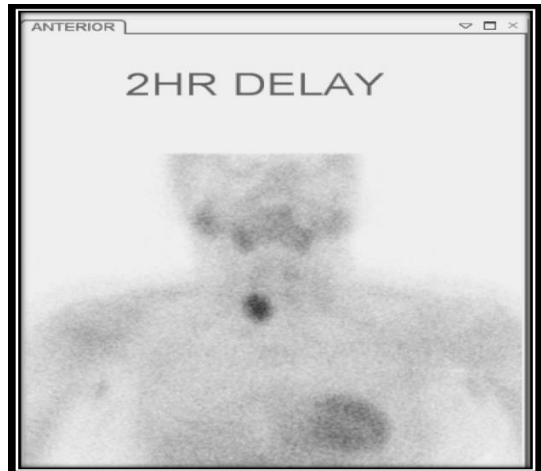
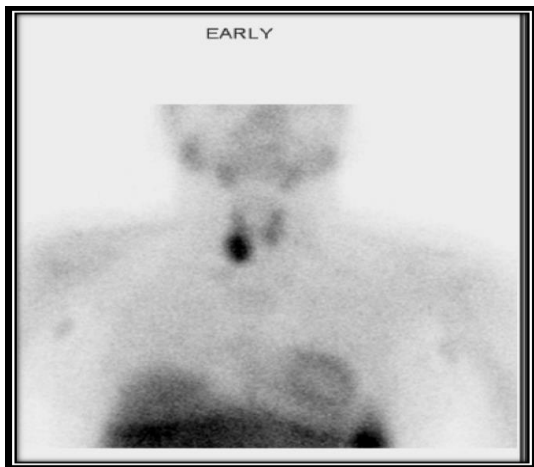
What are the imaging findings?

False negative because it is from the clear cells which has no mitochondria.

What is the most likely diagnosis?

Parathyroid adenoma.

High PTH and High Ca...II



What is the study?

Parathyroid scan & SPECT CT.

What is the agent used?

Tc-99m Sestamibi (Dual Phase).

What are the imaging findings?

right lower parathyroid adenoma anterior to trachea
approved by SPECT CT (arrow).

What is the most likely diagnosis?

Parathyroid adenoma.

What is your advice to do other procedure to help surgeon ?

Order SPECT CT to localize tumor

What is the study?

Parathyroid scan and SPECT CT.

What is the agent used?

**Tc-99m Sestamibi
(Dual Phase) (SPECT CT)**

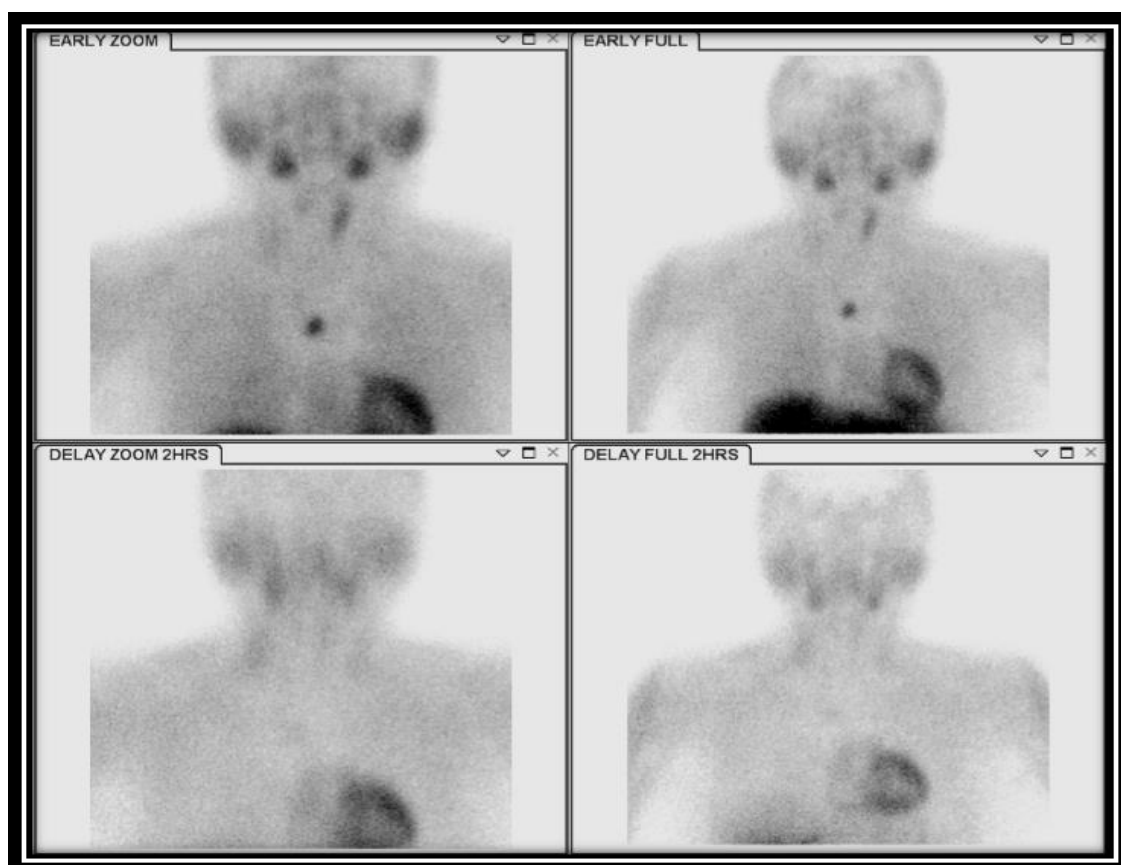
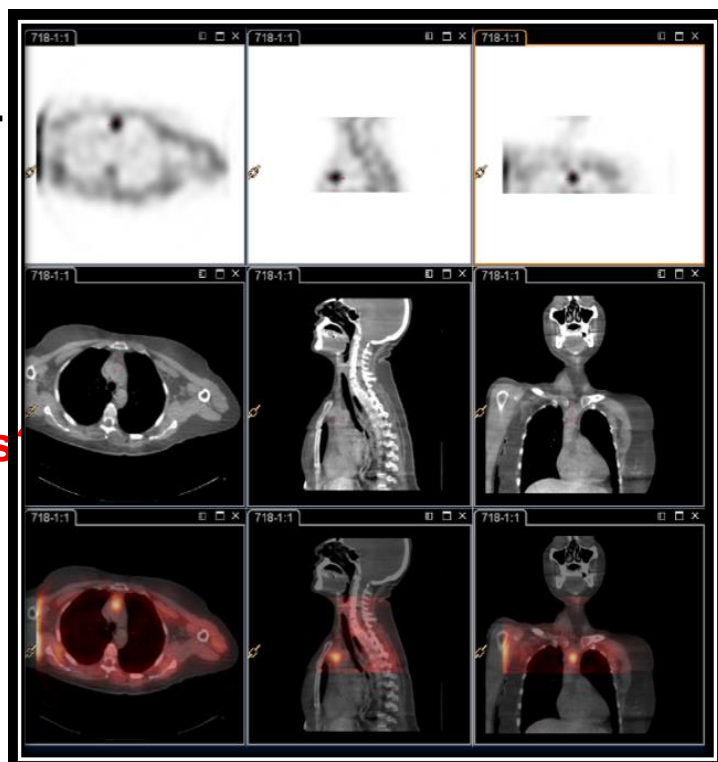
What are the imaging findings?

Ectopic retrosternal nodule

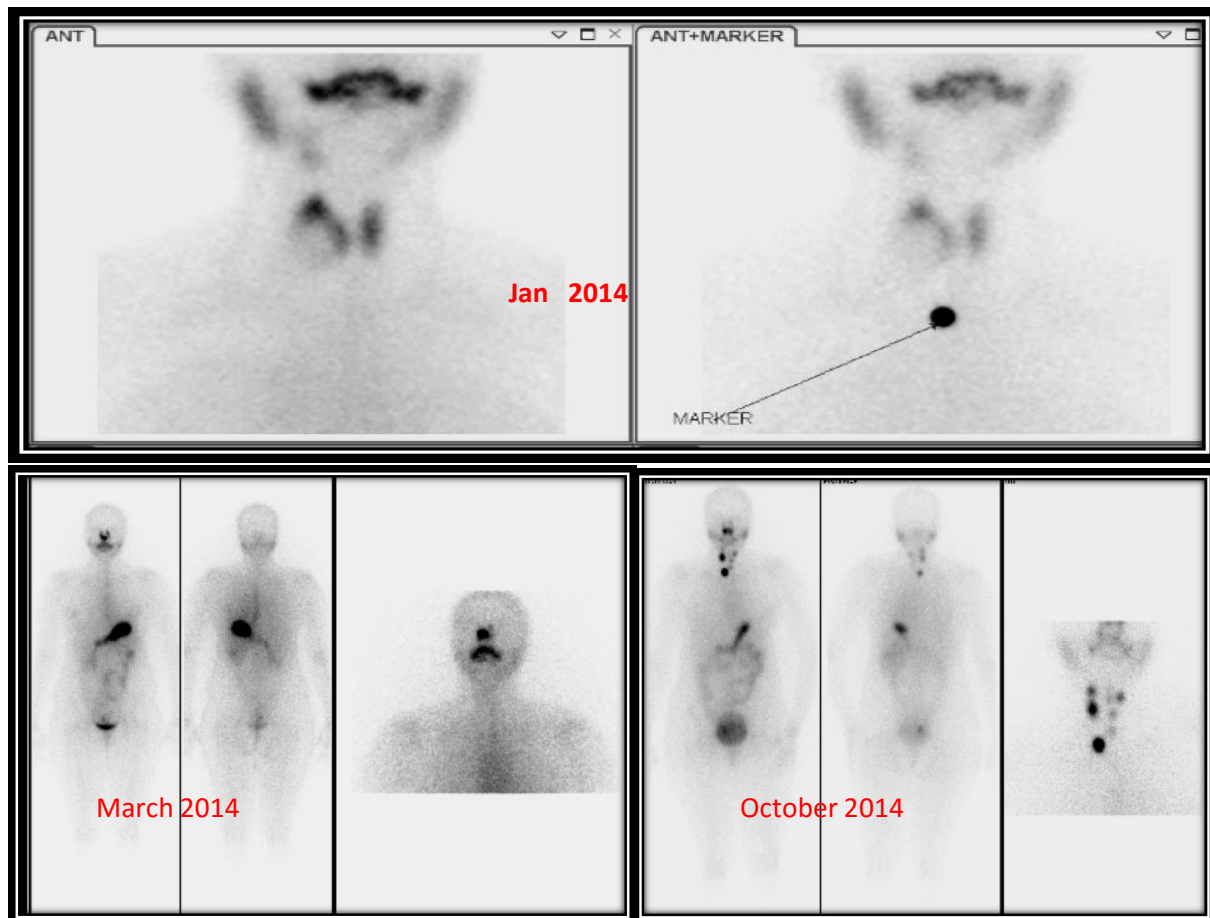
What is the most likely diagnosis?

What is the plan of treatment?

Thoracic and endocrine need to involve surgery in this case



A32 years old female patient with neck swelling



What is the study?

thyroid scan

What is the agent used?

Tc-99m Sestamibi (Dual Phase)

What are the imaging findings?

in **JAN 2014** we have cold nodule in right lower lobe of thyroid we do thyroidectomy we didn't operate lymph node

on **MARCH 2014** we see multiple hot nodule that spread locally in the neck to lymph node we suspect this patient to have papillary carcinoma (due to mode of transmission) we give her radiation therapy with iodine 131

OCTOBER 2014 we do scan to exclude any remnant . patient respond to treatment

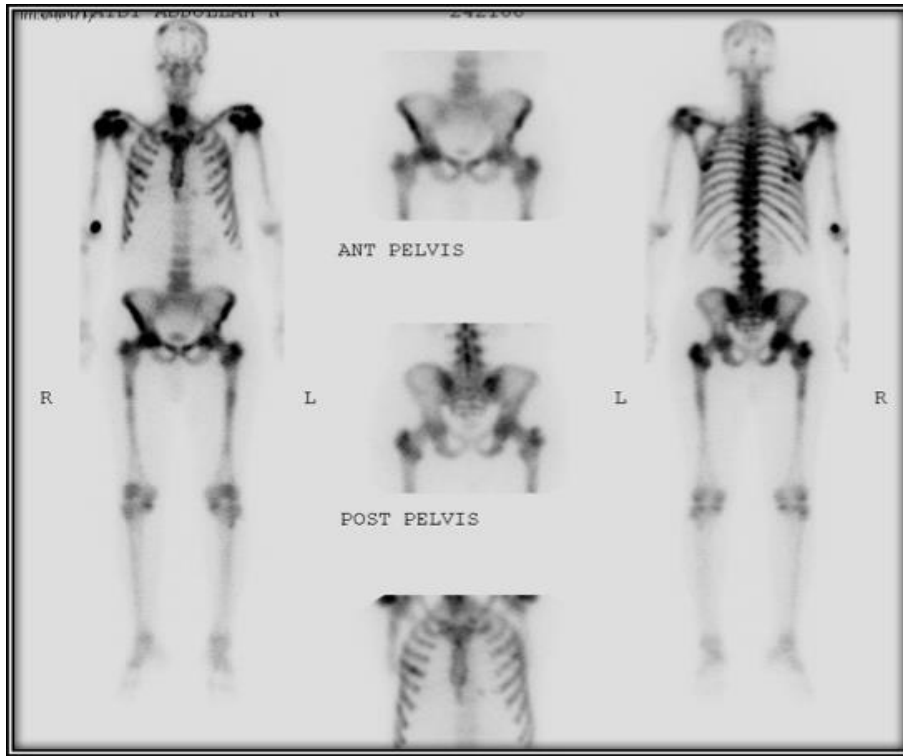
What is the most likely diagnosis?

papillary carcinoma

prognosis ?

It is good because papillary has locally spread

- A 66 years old male patient with elevated PSA and back pain



- What is the study?

Bone scan

- What is the agent used?

Tc-99m MDP with prostate compound

- What are the imaging findings?

Superscan (Diffuse increased skeletal uptake) > bone metastasis

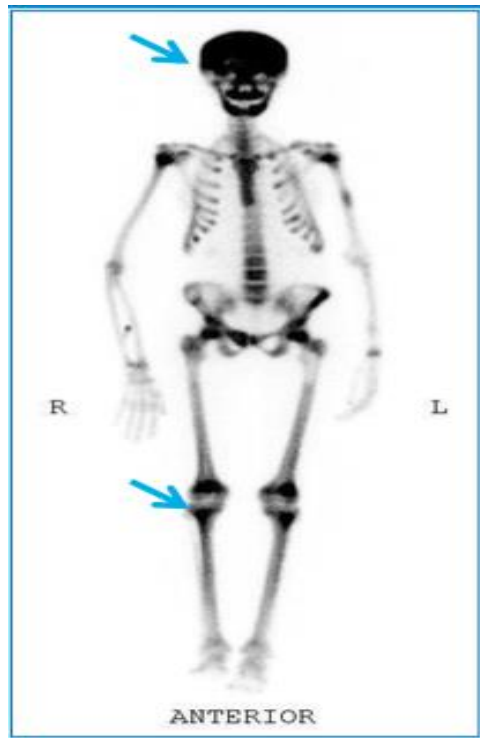
- What is the most likely diagnosis?

Prostate Cancer

- Examples of cancer can cause bone metastasis:

Breast, lung, bladder, rectum, stomach cancers .

A 24 year old male patient with back pain



Metabolic



Metastatic

We have 2 types of superscan:

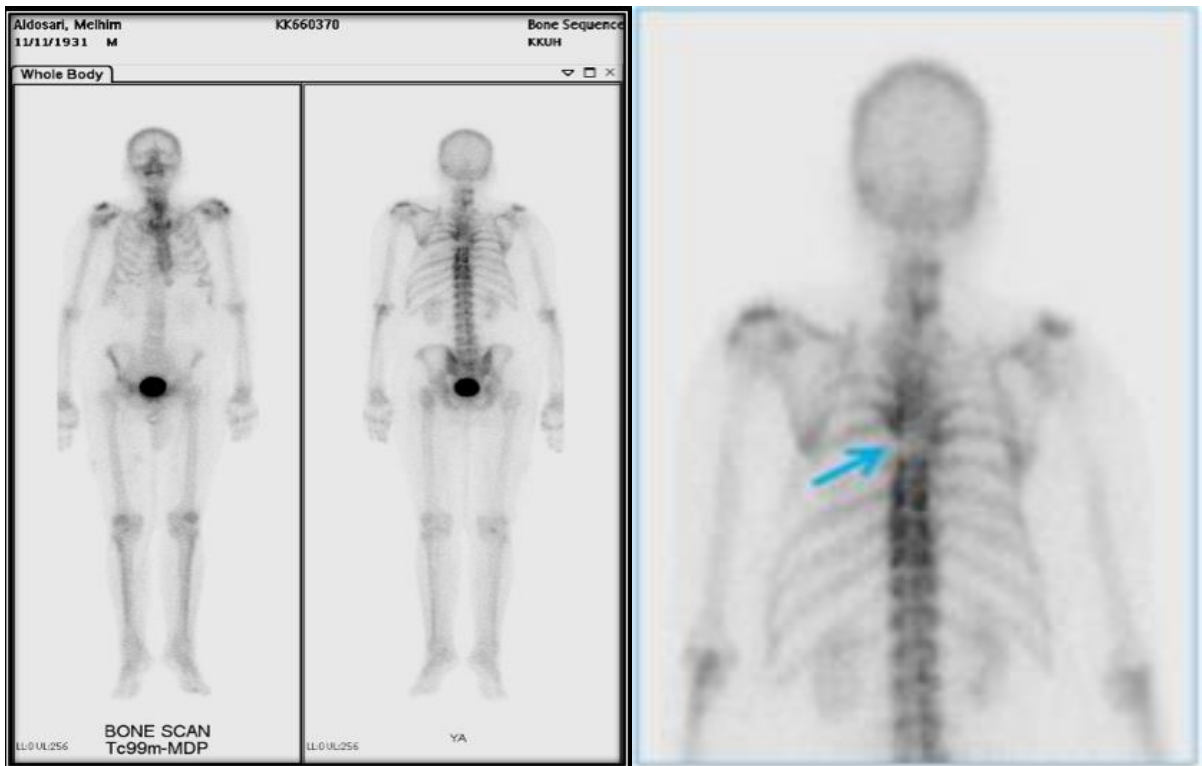
Metabolic

Involve of both axial and appendicular bones.

Mtastatic

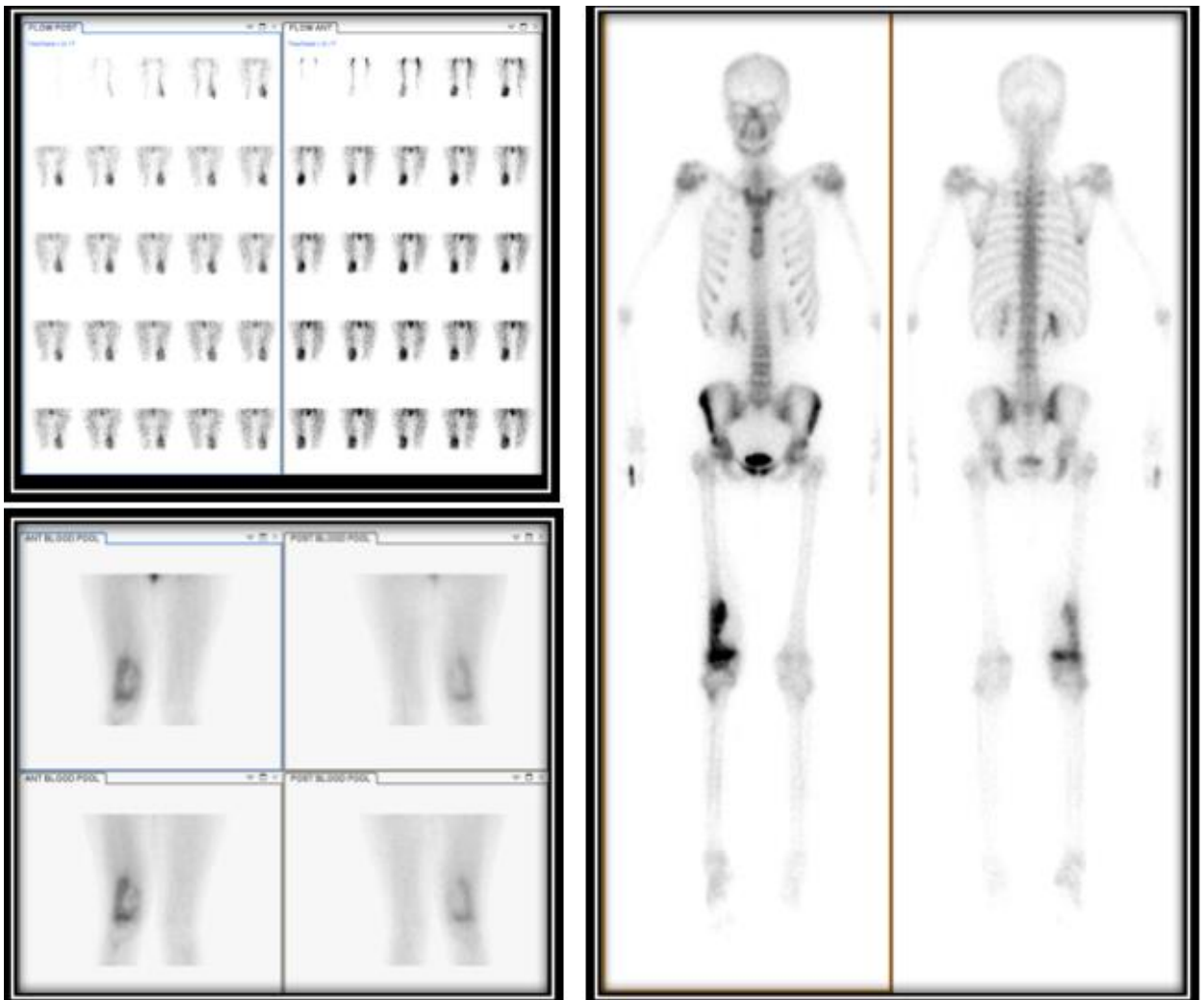
Involve only the axial bones e.g. (Prostate cancer-breast cancer-lung cancer-lymphoma).

- What is the study?
Bone scan
- What is the agent used?
Tc-99m MDP
- What are the imaging findings?
Superscan (Diffuse increased skeletal uptake)
- What is the most likely diagnosis?
Metabolic bone disease (hyperparathyroidism)
- Give other Examples of metabolic bone disease:
Osteomalacia, Pagets disease and fibrous dysplasia



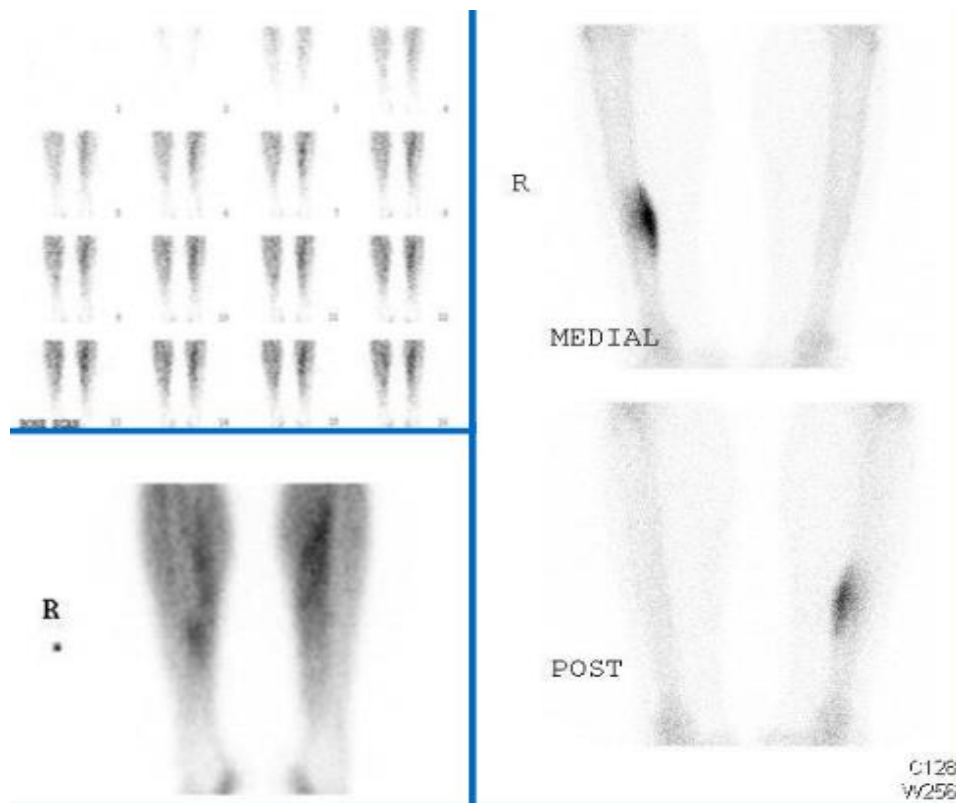
- What is the study?
Bone scan
- What is the agent used?
Tc-99m MDP
- What are the imaging findings?
Cold nodule (Arrow) defect in spine.
- What is the most likely diagnosis?
Pure osteolytic lesion (Renal cell carcinoma).
- Give other examples of pure lytic lesion:
Thyroid cancer , anaplastic tumor , multiple myeloma radiation therapy.
- NOTE: (This patient has Renal Cell Carcinoma and you can see the **cold lesions**. It is a destructive lesion; it doesn't induce an osteoblastic activity. **From its name (Pure Lytic Lesions) easy to remember.** So not all bone metastases appear as hot lesion)

A 17 year old female with right thigh mass

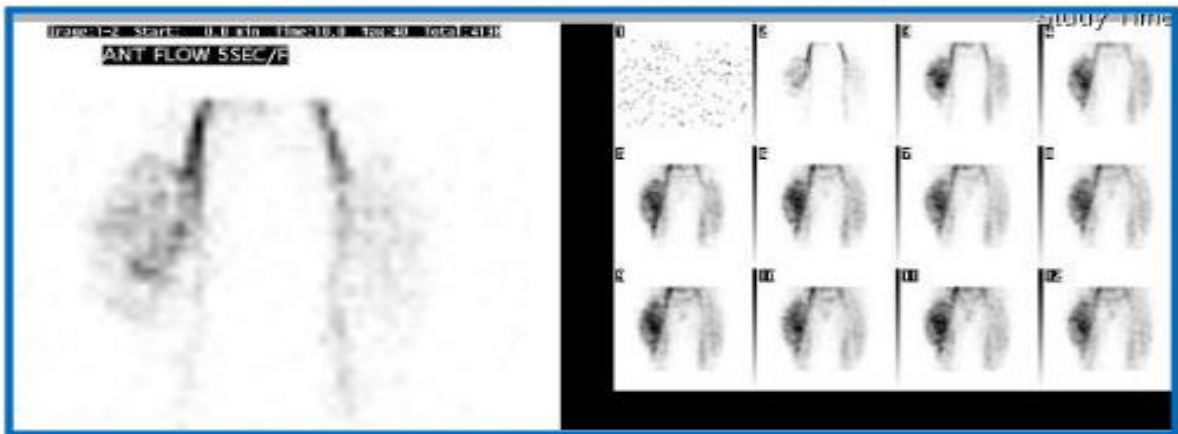


- What is the study?
Bone scan (3 phases)
- What is the agent used?
Phosphate.
- What are the imaging findings?
Area of increased blood flow and uptake.
- What is the most likely diagnosis?
Soft tissue sarcoma.

A 10 year old male patient presented with leg pain no allowing him to play football



- What is the study?
Bone scan
- What is the agent used?
Tc-99m MDP
- What are the imaging findings?
Tumor localized in the mid shaft of the right tibia.
- What is the most likely diagnosis?
Osteoid osteoma.
- More common in pediatric: Primary benign bone tumor characterized by night pain that is relieved by aspirin



- What is the study?
Bone scan
- What is the agent used?
Tc-99m MDP
- What are the imaging findings?
Large soft tissue sarcoma in the right thigh with underlying erosion of bone but with no metastasis.
- What is the most likely diagnosis?
Soft tissue tumor

- A 3 year old female patient with Opsoclonus Myoclonus Ataxia syndrome

- What is the study?

Spect CT

- What is the agent used?

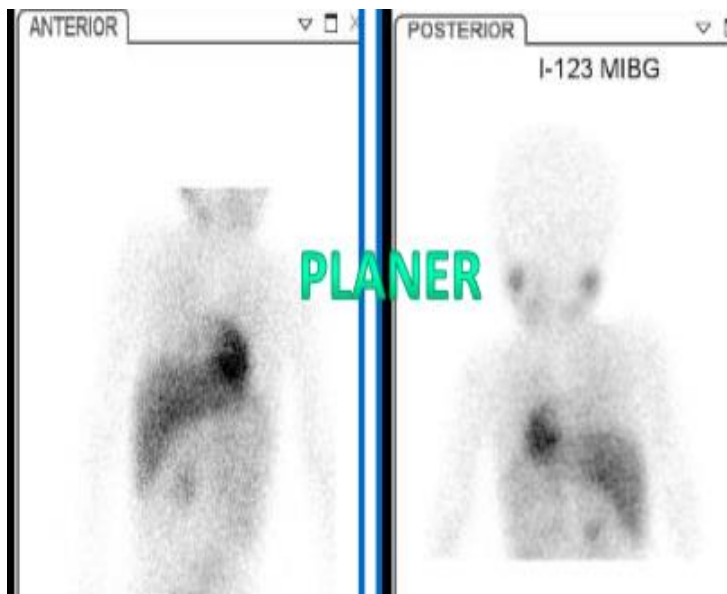
I-123/131 MIBG

- What are the imaging findings?

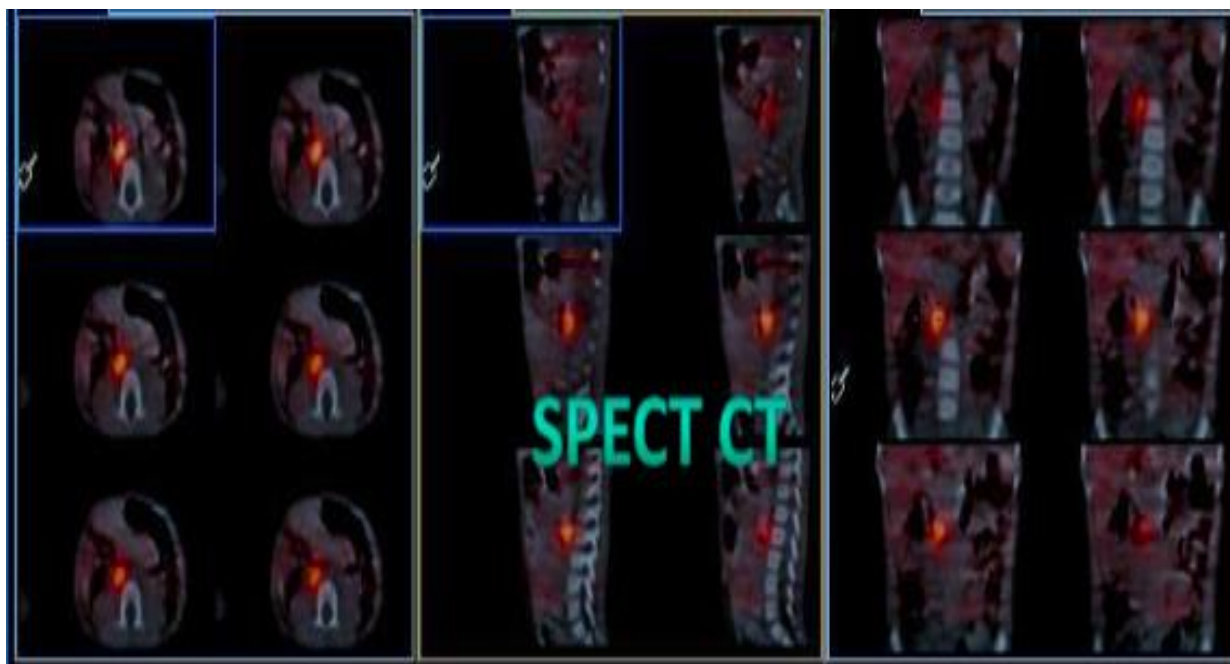
Focal area of increased uptake in the right med abdomen (right paraspinal)

- What is the most likely diagnosis?

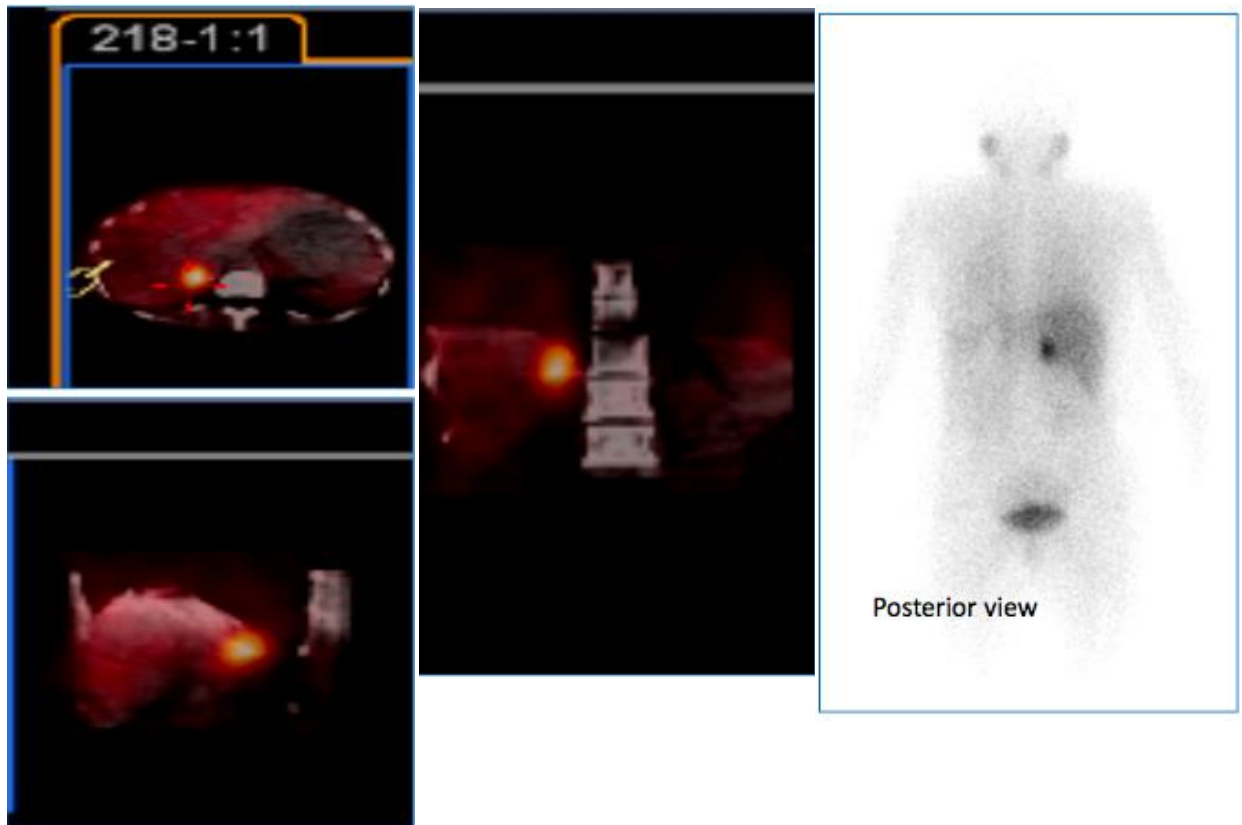
Neuroblastoma



This is a patient with Neuroblastoma, we can see the primary tumor in the planer image but we cannot know where is it exactly. But in SPECT CT it shows the accurate location of Neuroblastoma in this child, right paraspinal.



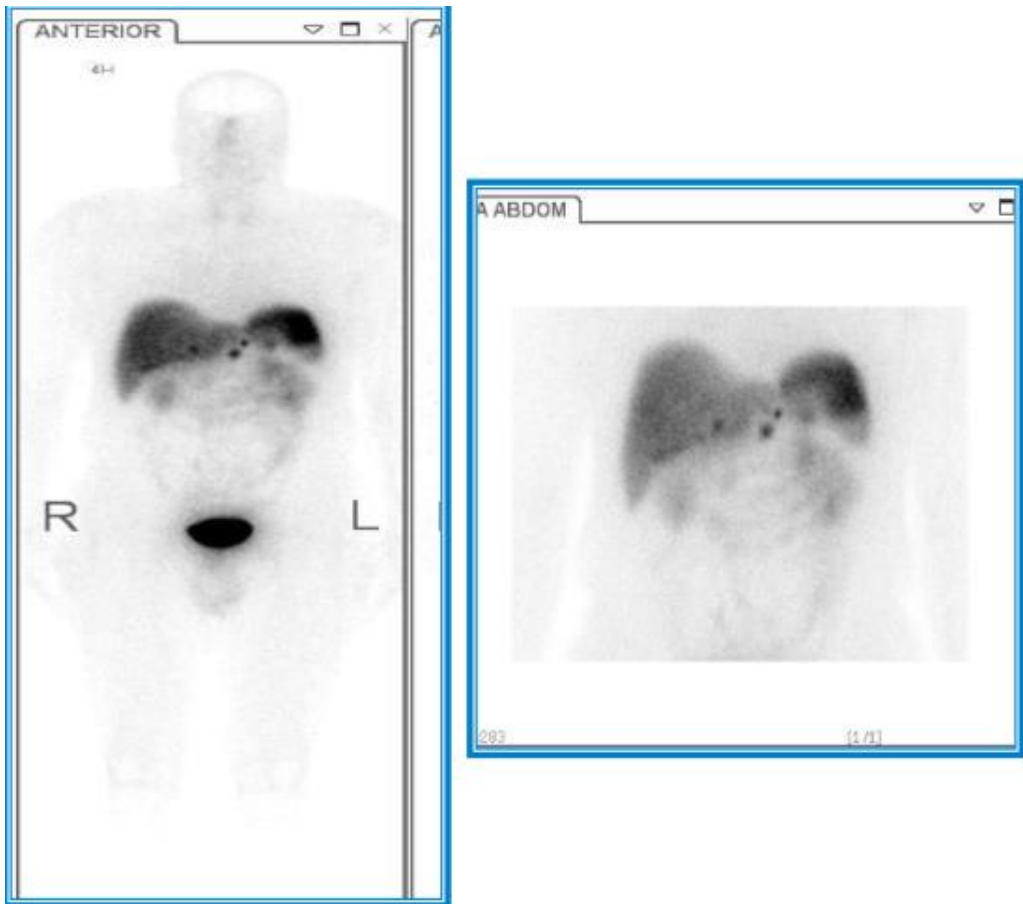
41 years old female patient is with hypertension. ? Secondary HTN



- What is the study?
SPECT CT.
- What is the agent used?
I-123/131 MIBG
- What are the imaging findings?
Increased uptake of the right adrenal gland.
- What is the most likely diagnosis?
• **Pheochromocytoma**
- What are the causes of secondary HTN?
Renal artery stenosis

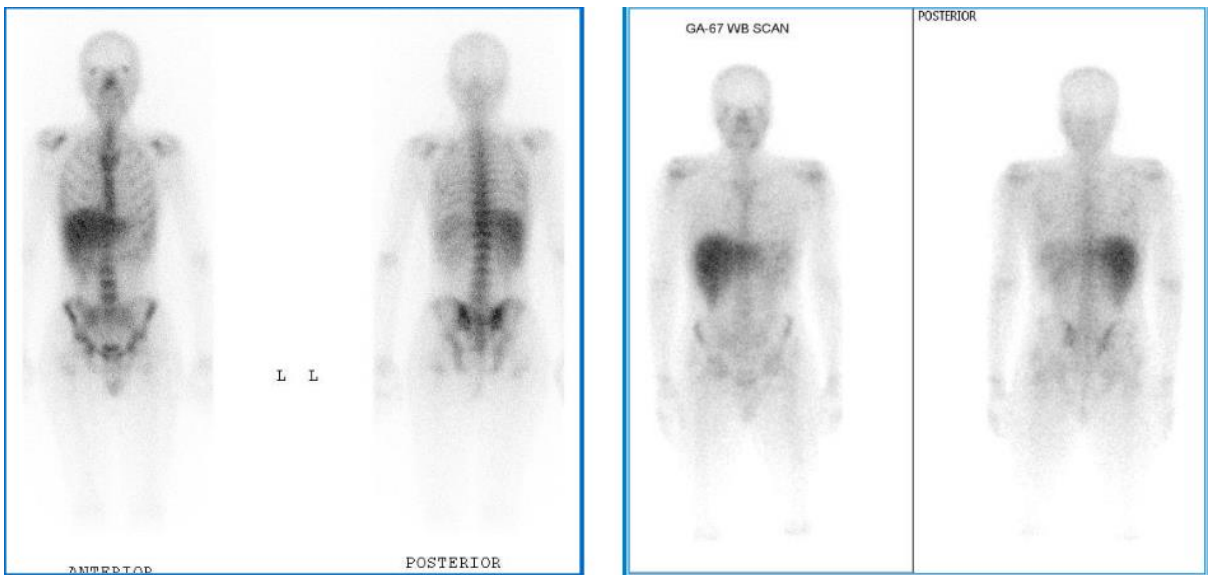
Pheochromocytoma is diagnosed by present of markers in blood (Catecholamine's) and in urine (Vanilly Mandelic Acid)

Patient with neuroendocrine tumor

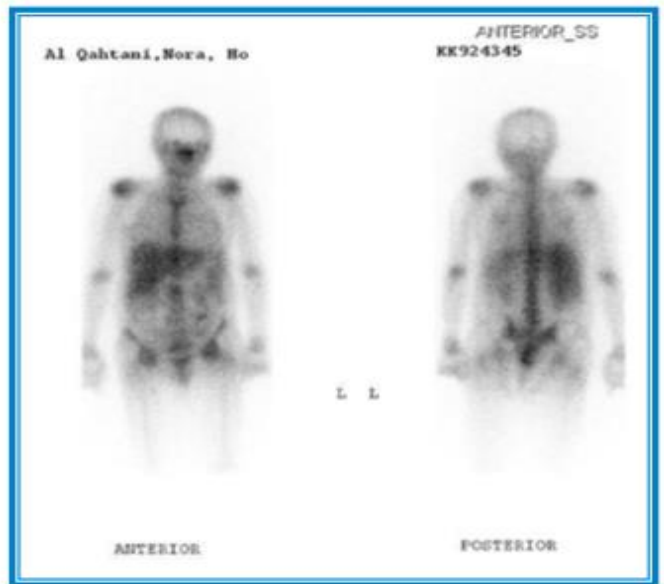
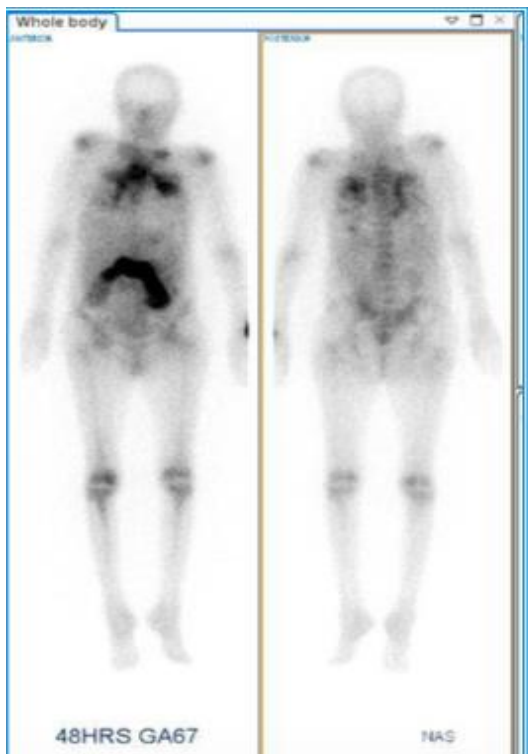


- What is the study?
Spect CT
- What is the agent used?
In-111 octreoscan/ MIBD
- What are the imaging findings?
Multiple metastasis in the abdomen
- What is the most likely diagnosis?
Neuroendocrine tumor
- Give examples of neuroendocrine tumors: **Pheochromocytoma, Paraganglioma, Insulinoma, Neuroblastoma, Medullary, Thyroid carcinoma and Carcinoid tumors**

Normal distribution: Ga-67scan



- What is the study?
Gallium scan
- What is the agent used?
Gallium
- What are the imaging findings?
Multipule lymph nodes above and below the diaphragm with spleen involvement
- What is the most likely diagnosis?
Lymphoma,, stage4



- **What is the study?**
Gallium scan
- **What is the agent used?**
Gallium
- **What are the imaging findings?**
Before chemotherapy: lymph node above and below the diaphragm. After chemotherapy: clear image
- **What is the most likely diagnosis?**
This scan was used to follow up the a patient with Lymphoma,, stage4
- **When do we ideally do the follow up scan?**
2 weeks after the last dose of chemotherapy

MCQs

- Which one of the following is more common in pediatric than adults:
 - a) Primary benign bone tumor characterized by night pain that is relieved by aspirin
 - b) Colon cancer
 - c) Breast cancer in females childs

- Which of the following is detected in urine of pheochromocytoma patients:
 - a) Cyanide
 - b) Vanilly Mandelic Acid
 - c) glocurea

1(a) 2(b)