MULTIMODALITY IMAGING OF PRIMARY HYPERPARTHYROIDISM

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- Multi-modality parathyroid imaging: A shifting paradigm 2023
- Contemporary Multimodality Imaging of Primary Hyperparathyroidism 2022
- Parathyroid Imaging: Past, Present, and Future 2022

- Parathyroid imaging: technique and role in the preoperative evaluation of primary hyperparathyroidism 2007
- Parathyroid 4D CT: What the Surgeon Wants to Know 2020

- Primary hyperparathyroidism (PHPT) is characterized by hypercalcemia in association with an elevated or inappropriately normal parathyroid hormone (PTH) level.
- routine biochemical testing has increased the numbers of asymptomatic diagnoses. The incidence increases with age, and postmenopausal women are disproportionately affected (2). Individuals of African American descent are at greater risk.

- More than 95% of all cases of PHPT are sporadic, and ionizing radiation and chronic lithium therapy are known environmental risk factors .
- Approximately 5% of cases occur as part of inherited or familial syndromes in which causal genes are recognized. These entities include multiple endocrine neoplasia (MEN) 1, MEN 2A, and MEN 4 syndromes; tumor jaw syndrome; and familial isolated PHPT

- Glands are composed primarily of chief cells with fat and thin fibrous capsules dividing the gland into lobules.
- There are also Oxyphil cells which are larger than the chief cells that have acidophilic cytoplasm due to mitochondria with no secretory granules.
- Stromal fat is also present

- Parathyroid tissue may have a pseudofollicular pattern resembling thyroid follicles
- however it is differentiated from thyroid tissue in that it lacks birefringent calcium oxalate crystals detectable by polarized light microscopy

- he culprit glands causing PHPT consist of either one or a combination of these cell types, although chief cell adenomas are the most common

- in humans, there are typically 4 paired parathyroid glands, two superior and two inferior.
- However, 10% of people have 2-3 glands, 5% of people have 5 glands, and 0.2% of people have 6 glands and the number of supernumerary glands in humans has ranged up to 11 in an autopsy series

- fewer than four glands were reported in 3%–6% of individuals, and more than four glands were found in 5%–13% **
- As many as 16% of parathyroid glands are ectopic in location (Fig 3), more commonly the inferior glands than the superior

- Normal glands measure a few millimeters, weigh an average of 35 mg (5), and are difficult to visualize with imaging.
- The average size of a normal parathyroid is 5 × 3 × 1 mm; normal glands weigh between 40 and 50 mg.**
- The normal shape of the parathyroid gland is ovoid or bean shaped and it measures 4-6 mm in length, 2-4 mm in width and 1-2 mm in thickness**

- They are thus infrequently identified at imaging

- The superior parathyroid glands lie close to the upper pole or interpolar region of each thyroid lobe
- while the inferior glands abut the lower pole of each lobe in approximately 84%–95% of cases (6).
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- The remaining glands are seen in a variety of ectopic locations between the angle of the mandible and the mediastinum.
- A meta-analysis involving eight studies (6) showed that approximately 3%–12% of glands were in ectopic neck locations and up to 5% were mediastinal, predominantly intrathymic.
- Ectopic parathyroid tissue has an incidence as high as 35% **

- It is a common cause of persistent or recurrent HP and failure of parathyroid surgery
- The superior and inferior glands are derived from the fourth and third branchial pouches, respectively.

- There is greater variation in the locations of inferior glands owing to their prolonged embryologic course of descent with the thymus.
- Therefore, ectopic inferior glands are found anywhere along the migration path of the thymus, generally caudad to the carotid bifurcation.
- These glands are usually medial to the path of the carotid arteries.

- These glands are usually medial to the path of the carotid arteries. They can arise in an undescended submandibular position, along the thyrothymic ligament, and elsewhere in the anterior superior mediastinum, or they may be intrathyroid or intrathymic.

- Ectopic superior glands are less common and tend to be found more posteriorly in a retroesophageal or paraesophageal location.
- Sites include the tracheoesophageal groove, carotid sheath, and posterior superior mediastinum down to the aortopulmonary window (7).

- A parathyroid gland, whether normal or abnormal, surrounded entirely by thyroid parenchyma with no capsule is considered an intrathyroidal parathyroid
- occurs due to aberrant migration of the parathyroid glands during embryogenesis

- The incidence of true functioning intrathyroidal parathyroid gland represents less than 1% of all hyperparathyroidism cases in a large series (37, 38)
- with 3:1 female predominance.
- Over 400 cases of intrathyroidal parathyroid adenoma have been described in case reports and series,

- In approximately 80% of cases, PHPT is caused by a solitary eutopic or ectopic adenoma (Fig 2). Multigland disease, including multiple adenomas and four-gland hyperplasia, accounts for 15%–20% of PHPT cases. Parathyroid carcinoma is rare

- In parathyroid hyperplasia there is typically more than one gland involved
- Hyperplastic parathyroid cells may show clonality and involve mainly the chief cells
- Parathyroid hyperplasia can be sporadic or in patients with a history of prior radiation to the neck.

- In the setting of MEN1 or 2A patients may begin with multigland hyperplasia and progress to multiple adenomas.
- Hyperplasia of parathyroid adipose tissue is rare.

- In primary chief cell hyperplasia, there is increased production of PTH associated with MEN1 or MEN2A.
- There is no association with MEN2B.
- Parathyromatosis, when microscopic foci of hyperplastic parathyroid tissue are found in the neck, is associated with chief cell hyperplasia and prior surgery (

- Cystic parathyroid lesions often contain turbid or colored fluid, present at all ages, and can be diagnosed by FNA where high PTH is found in the fluid (42).
- Cysts measure 1-10 cm and are unilocular, and thin walled.

- Functional parathyroid cysts are more common than nonfunctional parathyroid cysts
- (44). Patients are usually normocalcemic and present with an asymptomatic neck mass, including in the low cervical region and anterosuperior mediastinum.

- They may occur in a hyperplastic gland (45), due to cystic degeneration within an adenoma, or within heterotopic salivary gland-like tissue
- Cystic parathyroid lesions are a common cause of false negative results on molecular imaging.

- Parathyroid adenoma (PA) typically involves a single gland and represents neoplasia of parathyroid cells with nuclear pleomorphism more common than in hyperplasia (48).
- Chief cells within parathyroid adenomas are most commonly responsible for elevated PTH levels (49–51).

- Parathyroid adenomas more commonly involve the inferior glands over superior glands.
- Simultaneous adenomas can occur involving multiple glands (54).
- Parathyroid adenoma can mimic follicular thyroid neoplasm at FNA.

- The incidence of parathyroid adenoma has increased over the past 50 years, perhaps due to routine biochemical testing
- with adenomas often detected early in asymptomatic patients.
- Most are sporadic cases of unknown etiology.

- Women are more frequently affected
- it is common for adenomas to occur in the 30s-60s
- The condition is most commonly diagnosed in the fifth through seventh decades of life**
- a common endocrine disorder affecting approximately one in 500 women and one in 2,000 men.

- Syndromes associated with parathyroid adenoma include hyperparathyroidism jaw tumor syndrome (HRPT2 gene germline mutation)
- and multiple endocrine neoplasia (MEN1 > MEN2A) (54).

- Another rare cause of primary hyperparathyroidism is familial hypocalciuric hypercalcemia
- an autosomal dominant condition that produces PTH-dependent hypercalcemia.
- It is associated with mild parathyroid hyperplasia, but subtotal parathyroidectomy is not an effective treatment and is contraindicated in these cases.

- Risk factors include radiation exposure and long-term lithium therapy

- numerous studies comparing unilateral with bilateral approaches have shown similar success rates when preoperative imaging is highly suggestive of single-gland disease [7, 15–18].
- Cases of suspected multiglandular disease and those with equivocal preoperative localization still require the traditional bilateral cervical approach

- because imaging studies have been shown to have low sensitivity for the detection of hyperplasia and double adenomas.
- In addition, the surgical treatment for hyperplasia requires a bilateral approach;
- moreover, double adenomas are bilateral in most cases

- imaging is also important in the small percentage of cases of failed initial parathyroidectomy.
- Failures are most commonly due to undetected multiglandular disease
- but may also be due to ectopic glands or incomplete resection of a parathyroid tumor. I

- Parathyroid carcinoma is rare.
- At a large tertiary cancer center within the United States, a study identified only 20 patients over a 15-year
- Conventional structural imaging may be helpful to identify this entity as it is typically poorly circumscribed, which can distinguish it from parathyroid adenoma

- The mean diameter of parathyroid carcinomas at histopathology is suggested to be 3.4 cm with a weight of 19.2 g (60),
- The role of imaging in parathyroid carcinoma is primarily for evaluation of metastatic disease for which FDG PET/CT has demonstrated promise

- Rarely, neoplasms can involve the parathyroid through metastasis or direct involvement.
- the most common primary malignancies were breast carcinoma (66.9%), melanoma (11.8%), and lung carcinoma (5.5%)

- Patients with metastatic parathyroid lesions typically had widespread metastatic disease and were reported to develop abnormal calcium homeostasis even greater than those with primary parathyroid disease.
- Thyroid neoplastic disease is reported to typically secondarily involve the parathyroid gland by direct extension

- Imaging has no role in the diagnosis of PHPT, but it enables assessment of complications and aids in treatment planning.
- Guidelines recommend abdominal imaging to detect nephrocalcinosis or nephrolithiasis, and dual-energy x-ray absorptiometry to screen for reduced bone mineral density

- The parathyroid gland was discovered as an anatomic entity in humans less than 150 years ago. Its function was completely unknown for many years.
- When Von Recklinghausen described a case of a bone abnormality termed ‘osteitis fibrosa cystica’ in 1891, he was not aware of the cause[1].
- What he described is what we now know as a brown tumor or ‘Von Recklinghausen disease of bone’.

- In his autopsy note for this case, he mentioned *"at the left side of the neck below the thyroid gland a reddish brown lymph node is found"* prior to any known connection between these two entities

- he importance of accurate localization is illustrated in the case of Captain Martell. He underwent 5 unsuccessful parathyroid surgeries between 1926 to 1930. Finally, the sixth operation was successful, and a parathyroid adenoma was removed from the mediastinum (13–15). This patient illustrates the importance of pre-surgical localization.

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localization

- Management for patients with hyperparathyroidism is complex and multi-disciplinary
- The question radiologists are asked to answer is not “Does the patient have PHPT?” but rather “Where is the abnormal parathyroid tissue located?”

- Without a positive finding on imaging, it is unlikely that clinicians refer patients for definitive surgery

- The ideal parathyroid imaging professional is a vital contributor to a successful MIP program who substantially impacts patient care by aiding in the realization of MIP benefits

- The ideal parathyroid imaging professional is comfortable with and able to correlate the findings obtained from various imaging modalities and uses detailed knowledge of parathyroid embryology and anatomy to maximize chances of accurate and confident preoperative localization.

- Parathyroid imaging is cost saving
- For instance, a study from Frank et al. in 2020 found that whereas bilateral neck exploration costs $9578 with a success rate of 97.3%, single photon emission computed tomography (SPECT) imaging and minimally invasive parathyroidectomy (MIP) cost $8197 with a success rate of 98.6% (66).

- Contrary to some claims undermining the utility of preoperative imaging, the American Head and Neck Society (AHNS) Endocrine Section emphasized the necessity of precision preoperative localization to avoid unnecessary repeat operation
- and to address the concurrent thyroid pathology, which can be identified on parathyroid imaging, in the same operation

- The preferred localization technique is based on local expertise and availability.
- Guidelines for localization are flexible to reflect this variation

localization

- however, US in combination with ^{99m}Tc-sestamibi scanning or four-dimensional (4D) CT is recommended
- as it is considered the most cost-effective approach for initial investigation of parathyroid adenomas

- The most commonly performed and widely accepted imaging modalities for preoperative localization are US, nuclear medicine imaging, and multiphase (so-called four-dimensional [4D]) CT **

- Sonography and ^{99m}Tc-sestamibi scintigraphy are the dominant imaging techniques for preoperative location of parathyroid adenomas. **
- Numerous studies comparing these techniques suggest similar sensitivities and specificities for solitary adenoma detection

- Localization accuracy is also improved when both studies are obtained preoperatively
- Contrast-enhanced CT and MRI can also effectively locate parathyroid adenomas
- but are less commonly used for preoperative location
- and are more commonly used in the setting of failed parathyroidectomy for the detection of suspected ectopic—often mediastinal—glands.

- Rarely, cross-sectional imaging will be used if the findings at sonography and ^{99m}Tc-sestamibi scintigraphy are discordant.

- Each technique has advantages and disadvantages, with complementary rather than competing roles
- Second- and third-line modalities are considered in cases of difficult localization, repeat surgery, and contraindication to first-line techniques.

- These modalities include MRI, PET/CT with radiotracers such as fluorine 18 (^{18}F)-fluorocholine, and venous sampling with or without parathyroid arteriography.

- Imaging reports should detail the location, size, and number of all candidate lesions
- the depth of the lesion from the skin surface
- the relationship of the lesion with neighboring structures, including the major vessels, thyroid gland, trachea, and esophagus; variant anatomy; and the lesion's vascular supply if it is identified (17,18).

US localization

- US is inexpensive, readily available, and free of ionizing radiation.
- The cost of neck ultrasound is approximately $200, with other imaging studies costing over $1000
- By now, it is widely recognized that ultrasound can be helpful as a quick, well tolerated, cost effective first line imaging exam for patients with primary HP.

- Ultrasound is rarely the only preoperative imaging examination performed, and should not be relied upon in isolation in the usual standard of care for these patients.

- Reported sensitivities for the detection of solitary parathyroid adenomas with preoperative sonography range from 72% to 89% in recent large series **

- A meta-analysis encompassing 54 studies performed between 1995 and 2003 calculated sonographic sensitivities for the detection of
- solitary adenoma, hyperplasia, and double adenoma to be 79%, 35% and 16% respectively.

- retrospectively studied 226 patients with primary hyperparathyroidism and found preoperative sonography correctly identified all abnormal glands 77% of the time **

- The study of Milas et al. [38] involved 350 patients, and sonography correctly identified the site in 72% of patients.
- Although ultrasound is highly operator dependant in the detection of parathyroid adenomas, it has a sensitivity of 84% in the hands of an experienced sonologist

- These studies suggest the importance of a detailed knowledge of cervical anatomy and of operator experience in the successful use of sonography for preoperative localization.

- Multiple studies confirm the poor sensitivity of sonography for the detection of double adenomas.
- In the study of Haciyanli et al. [39], 21 of 287 consecutive patients were found to have double adenomas.
- A retrospective analysis of preoperative sonography showed a 40% sensitivity for detection of both adenomas [39].

- Similarly, Sugg et al. [40] found 23 cases of double adenoma in 233 consecutive patients, and sonography had a 23% sensitivity.
- The similarly low sensitivities seen with ^{99m}Tc sestamibi, a relatively operator-independent technique, might suggest double adenomas are an inherently different disease process than the typically easily shown solitary adenoma.

- Given the significant operator dependence of parathyroid sonography, comparisons between studies is particularly difficult

- identification of a single adenoma should not lead to a false sense of satisfaction of search

- In our recent experience, a high-quality sonographic examination is often sufficient for preoperative mapping of adenomas; nuclear medicine studies, although still routinely performed before attempted focused resection, often add little, although they may be helpful when sonography is nondiagnostic (e.g., with ectopic parathyroid adenomas)

- Turning the patient's head may help identify ectopic glands within the tracheoesophageal groove and deep paraesophageal regions.
- Even with use of these maneuvers, the identification of these ectopic "blind spots" is hampered by poor beam penetration.

- Some ectopic glands can be difficult to detect sonographically, particularly those in the retrotracheal region, because of the poor acoustic window caused by the tracheal air column.
- Sonography has poor sensitivity for detecting ectopic glands in the mediastinum as well.

- Concomitant thyroid disease also contributes to imaging pitfalls.
- Enlarged multinodular thyroid glands can limit the sonographic evaluation of parathyroid adenomas
- Anatomy is distorted and posterior nodules may mimic parathyroid disease

- The rare intrathyroid parathyroid gland is difficult, if not impossible, to distinguish from a thyroid nodule.

- US is less effective for detecting multigland disease
- a systematic review of 20 225 cases showed sensitivity decreasing to 35%, as compared with a sensitivity of 78% for the detection of solitary adenomas (20).

- Given the possibility of supernumerary glands, use of a systematic approach is imperative, even after an abnormal gland is identified.

- Normal parathyroid glands are small and flat, measuring only a few millimeters transversely
- Because these glands are not readily identified at imaging, an easily visible gland is suspicious for underlying disease.
- The normal parathyroid gland is difficult to reliably identify on ultrasound**

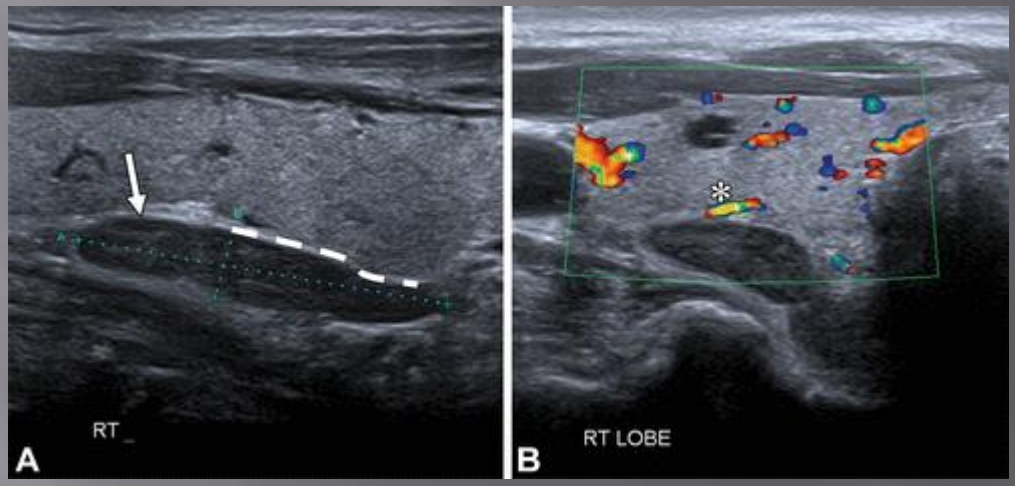
- The small size and deep location of the normal parathyroid gland makes it non-identifiable on ultrasound **

Adenoma us appearance

- Abnormal glands are typically homogeneously hypoechoic relative to the thyroid gland
- with a well-defined hyperechoic capsule
- Internal heterogeneity can result from fat, hemorrhage, or calcification. however, cystic degeneration is present in 1%–2% of cases.

- Doppler US assessment may reveal a feeding polar artery and peripheral arch of hypervascularity

- In contrast, lymph nodes have a hilar blood supply, hypoechoic cortex, and echogenic hilum.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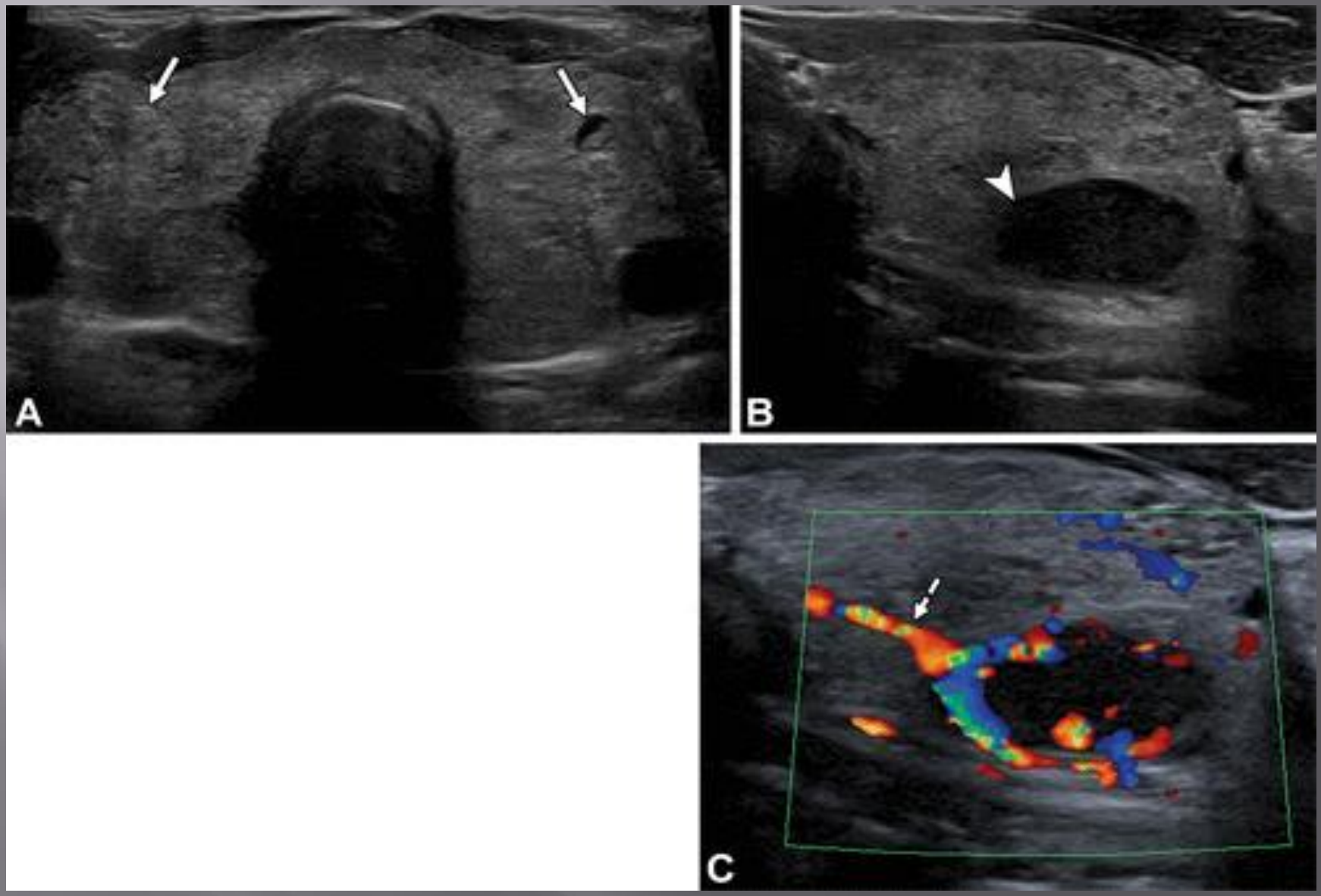
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FNA

- US-guided fine-needle aspiration (FNA) biopsy with PTH estimation can be diagnostic
- However, this is recommended for inconclusive or repeat surgery cases only
- as complications such as hematoma, post-FNA fibrosis, or seeding can occur in up to 5% of cases

FNA

- They also suggest that in rare instances, PTH assay of an ultrasound guided fine needle aspiration (FNA) of an indeterminate lesion along the posterior aspect of the thyroid can have a benefit **
- . There is however a risk of seeding parathyroid tissue **
- and in most cases FNA of parathyroid lesions is not necessary or recommended. **

FNA

- Parathyroid carcinomas are usually larger.
- The only reliable feature that suggests malignancy is invasion of surrounding structures
- If malignancy is suspected, FNA biopsy is contraindicated owing to the risk of seeding.

FNA

- In cases in which a more definitive preoperative localization is necessary and sonographic findings are equivocal, sonographically guided fine-needle aspiration (FNA) of the suspected gland with subsequent PTH assay has been shown to be a safe and highly specific
- A study by Stephen et al. [28] of 57 preoperative sonographically guided FNAs in 54 patients found a specificity of 100% and no false-positive findings.
- The three false-negative FNAs occurred when small glands were sampled..

FNA

- Although PTH aspiration is rarely necessary for routine cases
- this procedure can be particularly helpful in cases in which prior thyroid or parathyroid surgery has distorted neck anatomy
- or when preoperative confirmation of unusual-appearing or ectopic glands is needed.

FNA

- A theoretic complication of the procedure is seeding of abnormal parathyroid tissue along the biopsy track, resulting in an entity known as parathyromatosis.
- This has been described in cases of recurrent hyperparathyroidism after parathyroidectomy in which the capsule of the parathyroid gland was disrupted during the procedure.

FNA

- However, a study by Kendrick et al. [31] followed 81 patients after percutaneous parathyroid FNA for a mean of 5.8 years and found no cases of parathyromatosis

- US can simultaneously depict thyroid nodules
- Thyroid assessment is used to guide the surgical approach if a suspicious intrathyroid nodule is found ipsilateral to a parathyroid adenoma, in which case hemithyroidectomy can prevent repeat surgery.

- This is relevant because of the risk of coexistent papillary thyroid cancer or the rare association of medullary thyroid cancer with PHPT in hereditary syndromes

^{99m}Tc-Sestamibi Scanning Localization

- ^{9m}Tc–sesta-methoxyisobutylisonitrile, or ^{99m}Tc-sestamibi, accumulates in mitochondria-rich cells, including :
- myocardial cells; malignant cells; and overactive parathyroid glands.

- The accumulation of ^{99m}Tc-sestamibi in overactive parathyroid glands predominantly relates to their oxyphil cell content
- The radiotracer uptake also depends on other factors, such as blood supply, calcium levels, and expression of proteins such as P-glycoprotein and multidrug resistance–associated protein (16).

- Typically, parathyroid adenomas show focal increased radiotracer uptake during the early phase that persists at delayed phase imaging, in contrast to background thyroid activity, which shows washout

- In a meta-analysis (23), the pooled sensitivity of ^{99m}Tc-sestamibi SPECT for single-gland disease (78.9%) was comparable to the pooled sensitivity of US (76.1%)
- The reported sensitivity of ^{99m}Tc-sestamibi scintigraphy is similar to that of sonography. Recent large series using SPECT show sensitivities for detection of solitary adenomas in the range of 68–95% **

- The meta-analysis ,included 96 studies, between 1995 and 2003 , calculated the sensitivity for detection of solitary adenomas at 88% **
- Similar to sonography, sensitivities for detection of hyperplasia and double adenomas were low, calculated at 44% and 30% respectively

- A preoperative approach that combines both the anatomic information of sonography and the physiologic information of scintigraphy has been shown to predict the presence and location of solitary adenomas more accurately than either technique alone

- Both techniques remain similarly insensitive for the detection of multiglandular disease and double adenomas
- ugg et al. [40] retrospectively studied preoperative imaging findings in 23 of 233 patients found to have multiglandular disease

- and found that even when combining both techniques, multiglandular disease was correctly predicted in 30% of patients, single-gland disease was incorrectly predicted in 30%, abnormal parathyroid glands were not located in 30%, and discordant results were provided in 10%.

- Haciyanli et al specifically studied double adenomas and found combined techniques were only 60% sensitive

- Sonography has the advantage of being more specific regarding the site of an adenoma in relation to the thyroid gland.
- Scintigraphy clearly has an advantage in the detection of ectopic glands, particularly in the mediastinum.

- In a different study involving 184 patients (24), combining ^{99m}Tc-sestamibi scintigraphy with US significantly improved the sensitivity (81% [US and ^{99m}Tc-sestamibi scintigraphy combined] versus 70% [US alone] and 64% [^{99m}Tc-sestamibi scintigraphy alone]), and concordant imaging improved the surgical success.

- . Lumachi et al reviewed preoperative sonography and ^{99m}Tc-sestamibi, found a combined sensitivity of 95% versus 80% for sonography and 87% for scintigraphy alone**
- Similarly, Siperstein et al. [37] predicted 79% surgical success in their prospective study combining both techniques versus 74% for sonography and 68% for scintigraphy alone.

- ^{99m}Tc-sestamibi scanning, as compared with US, can also depict potential ectopic sites with higher sensitivities (25). The detection of multigland disease is a recognized limitation, and oxyphil-poor adenomas can show reduced radiotracer uptake

- Knowledge of the causes of false-positive and false-negative findings is important

Findings at ^{99m}Tc-Sestamibi Parathyroid Scintigraphy

False-positive findings
Thyroid abnormalities, including multinodular goiter, thyroiditis, and thyroid carcinoma: delayed thyroid washout
Lymph nodes
Malignancy
Brown fat
Brown tumors
False-negative findings
Small size
Multigland or ectopic disease
Paucity of oxyphil cells within an adenoma
Parathyroid hyperplasia: rapid parathyroid washout
P-glycoprotein or MDR gene expression: rapid parathyroid washout

Source.—Reference 29.

4D CT scan

- Parathyroid four-dimensional (4D) CT is an increasingly used and powerful tool for preoperative localization of abnormal parathyroid tissue in the setting of primary hyperparathyroidism

- However, many radiologists find the interpretation of these examinations to be an intimidating challenge

- Four-dimensional CT involves a three-phase protocol
- that includes a noncontrast arterial and delayed (venous) phase study in which the fourth dimension is time.
- The mechanism behind 4D CT is the enhancement pattern, which acts as a surrogate for the lesion's perfusion

- Although other institutions have modified protocols and performed imaging with two or four phases
- a systematic review of 34 studies (33) concluded that a three-phase protocol is best for balancing performance with radiation exposure.

- 4D CT is contraindicated in patients
- who are allergic to contrast medium or
- are undergoing radioiodine therapy for thyroid cancer.
- The risk of contrast agent–induced nephropathy makes renal failure a relative contraindication.

- The most important 4D CT information to the surgeon includes :
- number, size, and specific location of candidate parathyroid lesions with respect to relevant surgical landmarks;
- the radiologist's opinion and confidence level regarding what each candidate lesion represents.

- and the presence or absence of ectopic or supernumerary parathyroid tissue, concurrent thyroid pathologic conditions, and arterial anomalies associated with a nonrecurrent laryngeal nerve

- Among US, nuclear medicine and 4D CT :
- 4D CT has been shown to have several advantages,
- including superior diagnostic performance in most comparative studies as well as relative effectiveness in challenging clinical scenarios, such as nonlocalizing US and/or nuclear medicine imaging results multi glandular disease (MGD) and recurrent PHPT

- Three-phase 4D CT, as compared with ^{99m}Tc-sestamibi SPECT/CT, has been shown to facilitate superior localization.
- In a retrospective study involving 400 patients ,it was more sensitive for both single-gland (92.5% vs 75.1%) and multigland (58.2% vs 30.8%) disease
- In another smaller study (42), improved detection of smaller adenomas (Fig 15) and ectopic glands was described.

- There remain difficulties in identifying glands in multigland disease and concurrent thyroid goiter

- However, in order for the potential advantages of 4D CT to be realized for a given patient, the interpreting radiologist must have the requisite knowledge and expertise to provide an accurate interpretation, and many radiologists find 4D CT image interpretation to be intimidating, time-consuming, and difficult.

- No matter how many candidate lesions are found, there is always the risk that an additional unidentified parathyroid lesion is present
- Descriptions of candidate lesions are most useful when accompanied by the radiologist's opinion of what the lesion represents and level of diagnostic confidence.

- If other parathyroid imaging has been performed, careful review of these images, particularly US images, for concordance with the putative 4D CT image interpretation results may substantially improve diagnostic confidence.

- Diagnostic confidence (or lack thereof) has implications for the operative plan and in certain high-risk scenarios (eg, reoperative neck) may impact whether an operation is offered at all.

- Appropriate concerns have been raised regarding patient radiation exposure with a three-phase protocol
- However, we believe the benefits of increased diagnostic accuracy (38) likely outweigh the small attributable risk (39) in the typical middle-aged patient with PHPT

- Parathyroid adenomas are lower in attenuation than the normal (iodine-containing) thyroid gland on non–contrast enhanced images.
- In the setting of chronic hypothyroidism ,parathyroid adenomas may appear similar in attenuation to that of abnormal thyroid gland on non–contrast-enhanced images

- On contrast-enhanced images, adenomas are classically described as exhibiting higher attenuation than the thyroid in the arterial phase and lower attenuation than the thyroid (washing out) in the venous phase
- However, this classic appearance is seen in only 20% of adenomas

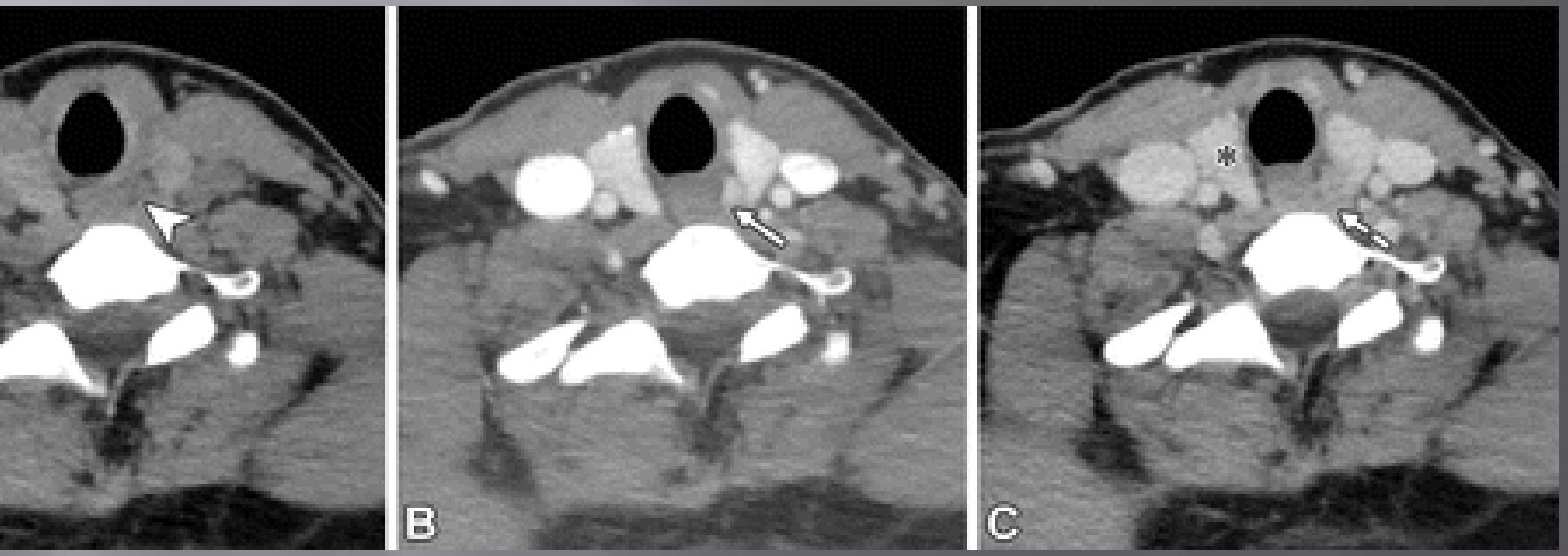
- In another described enhancement pattern, the adenoma has a lower degree of arterial enhancement than the thyroid gland but with greater washout during the delayed phase
- A small proportion of adenomas show enhancement and washout similar to those of the thyroid gland. Underlying cystic change

- In addition to varied enhancement patterns parathyroid adenomas may also exhibit cystic foci, fat deposition, or calcification
- Knowledge of these variant appearances maximizes lesion detection.
- Finally, the presence of a polar vessel increases confidence that a lesion is of parathyroid origin, as opposed to the hilar blood supply of a lymph node.

- MGD is also more likely when no parathyroid lesions are identified (88% specificity) (23).
- Parathyroid lesions in MGD also tend to be smaller.
- More specifically, the largest candidate lesion identified at 4D CT measuring less than 7 mm is 79% specific for MGD, even when only a single lesion is identified (23).

- Imaging features favoring MGD are worth emphasizing to the surgeon because of the implications for the operative plan
- Parathyroid carcinoma is rare and difficult to diagnose preoperatively.

- Markedly elevated parathyroid hormone is suggestive clinical features, and parathyroid calcifications on images should raise suspicion, especially in large parathyroid lesions.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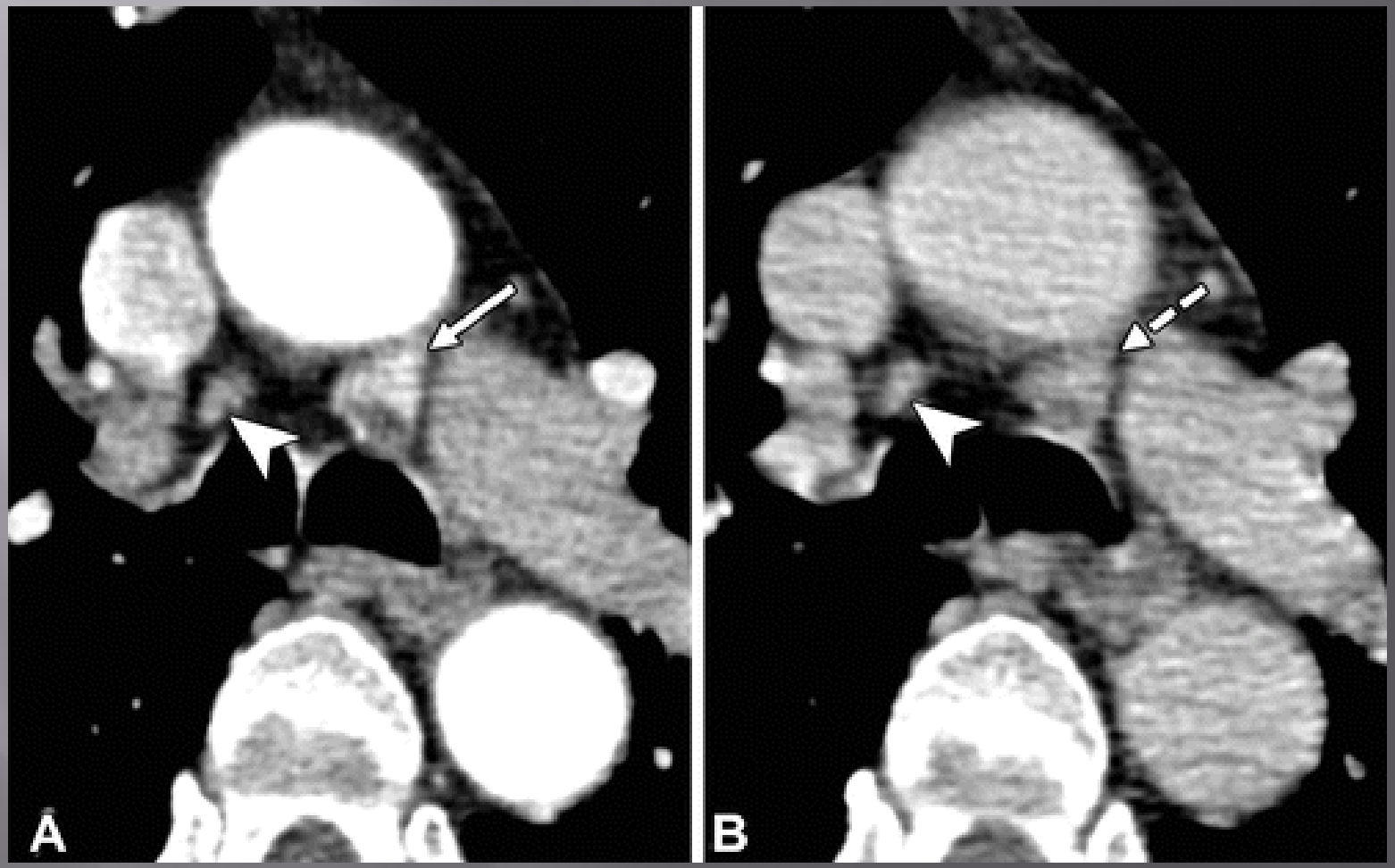
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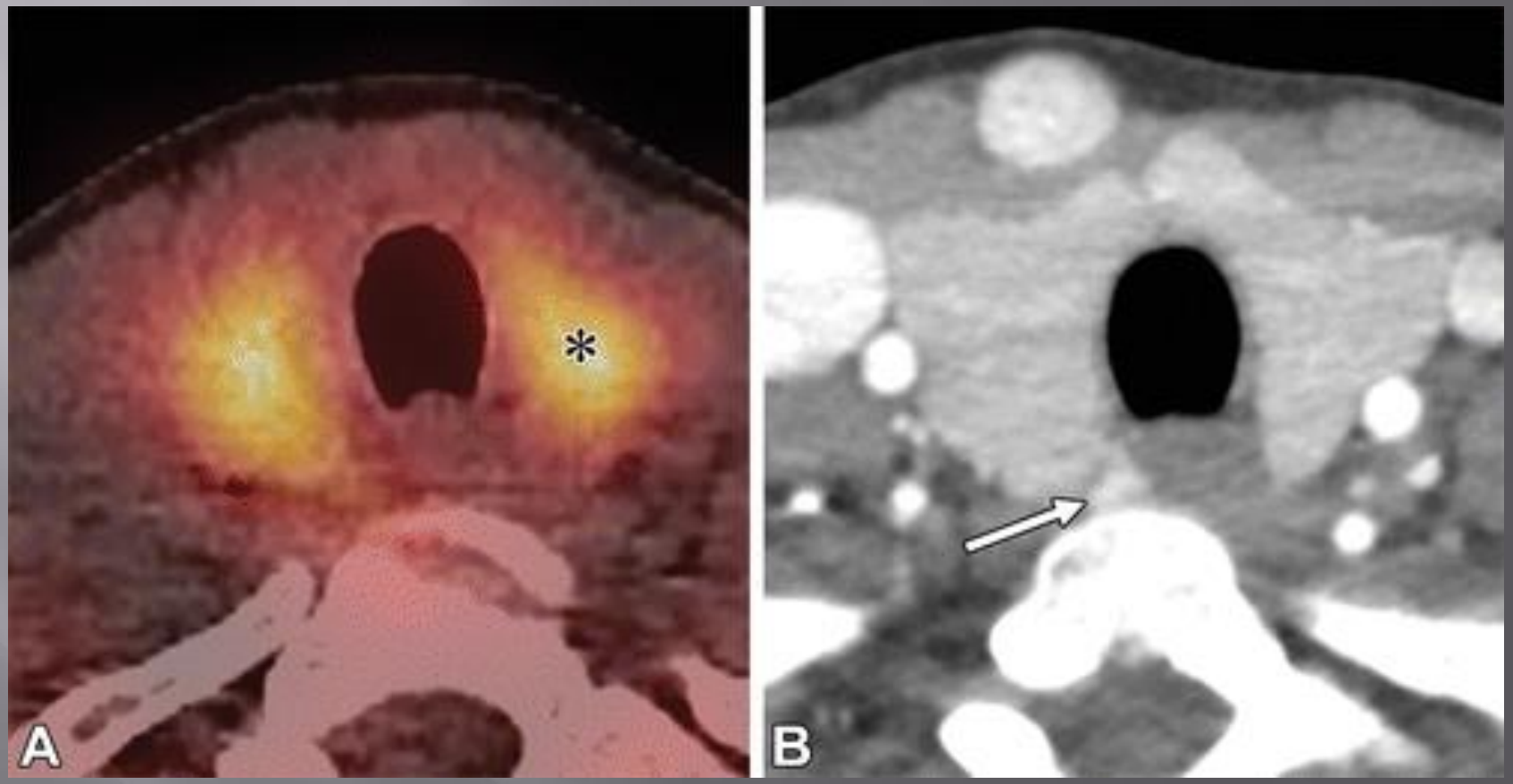
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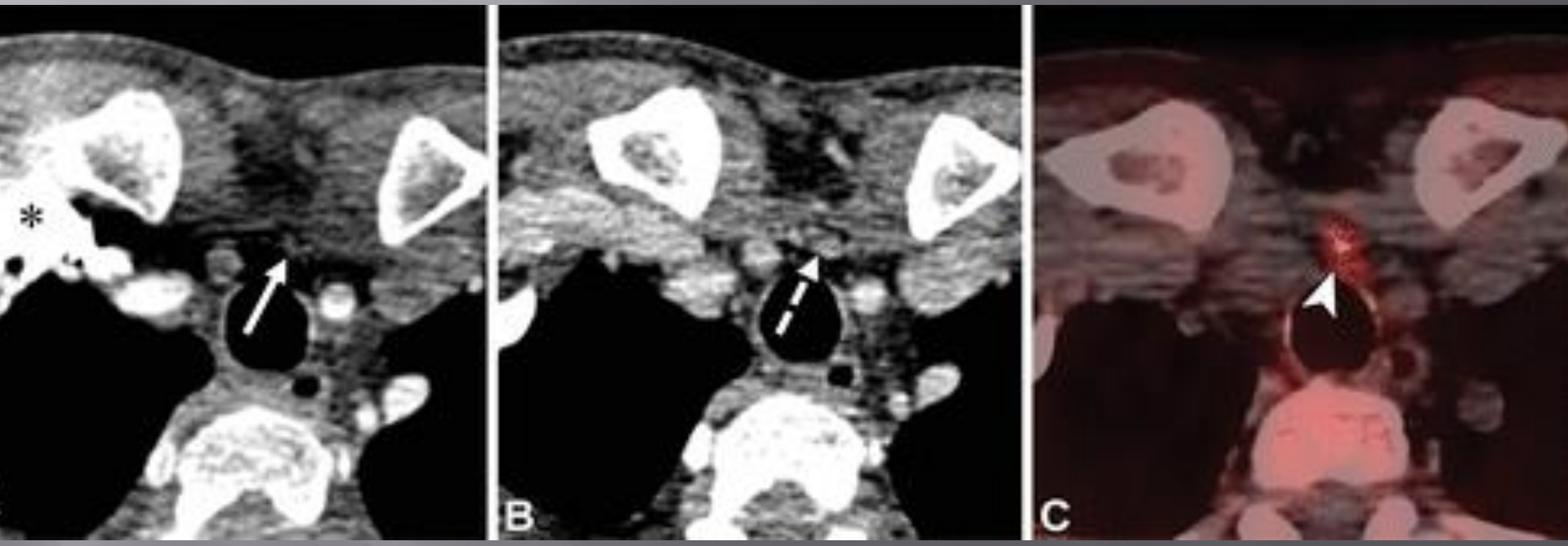
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Choline PET and PET/CT Localization

- In a meta-analysis of 14 studies of choline PET (12 with use of ^{18}F-fluorocholine and two with use of ^{11}C-choline) :
- high sensitivities (95%) were reported
- and a systematic review of 16 studies in which ^{18}F-fluorocholine PET/CT was used showed sensitivities ranging from 80% to 100%.
-

- The latter study highlighted the superiority of ^{18}F-fluorocholine PET/CT, as compared with first-line imaging :
- in the diagnosis of hyperplasia or multiple or ectopic adenomas and its specific role when first-line investigations yielded negative or inconclusive results.

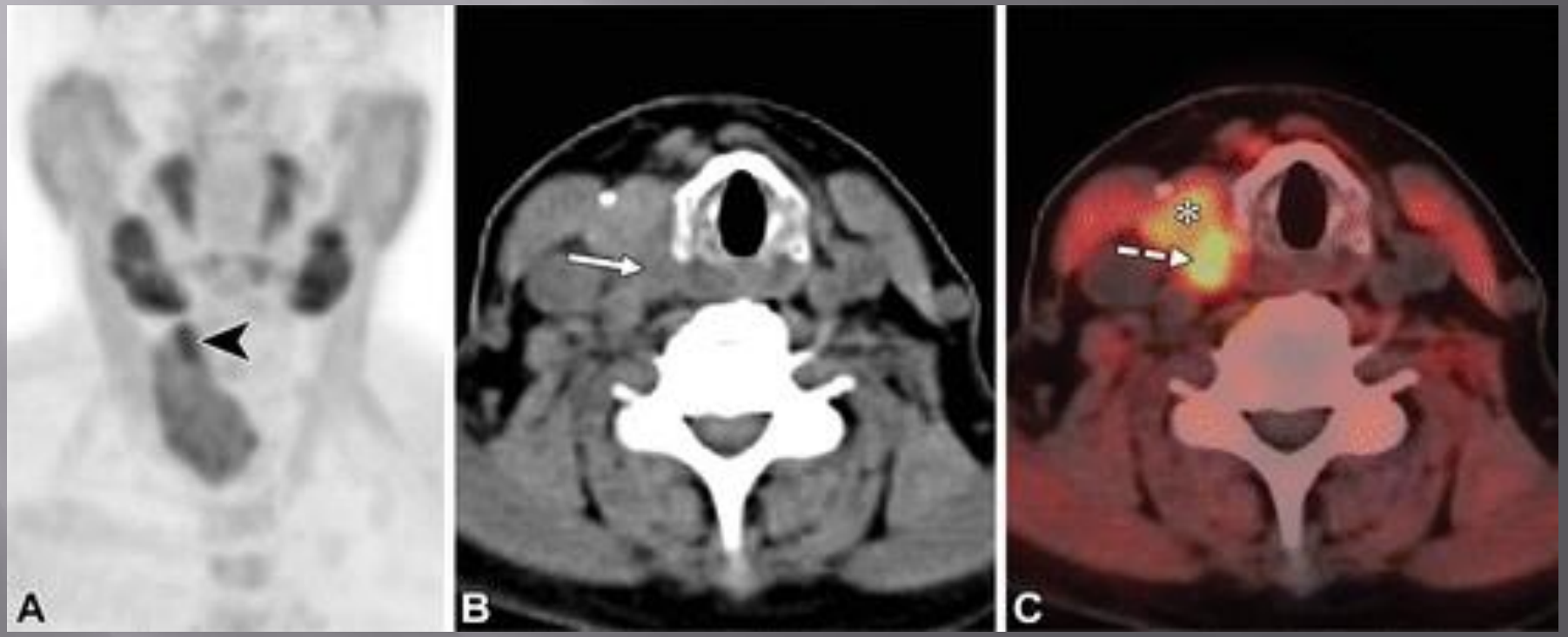
- Another recently published meta-analysis of 119 comparative studies involving the use of two or more imaging modalities and 8495 patients :
- showed that choline PET/CT, as compared with other modalities, had the best performance in patient- and lesion-based localization analyses

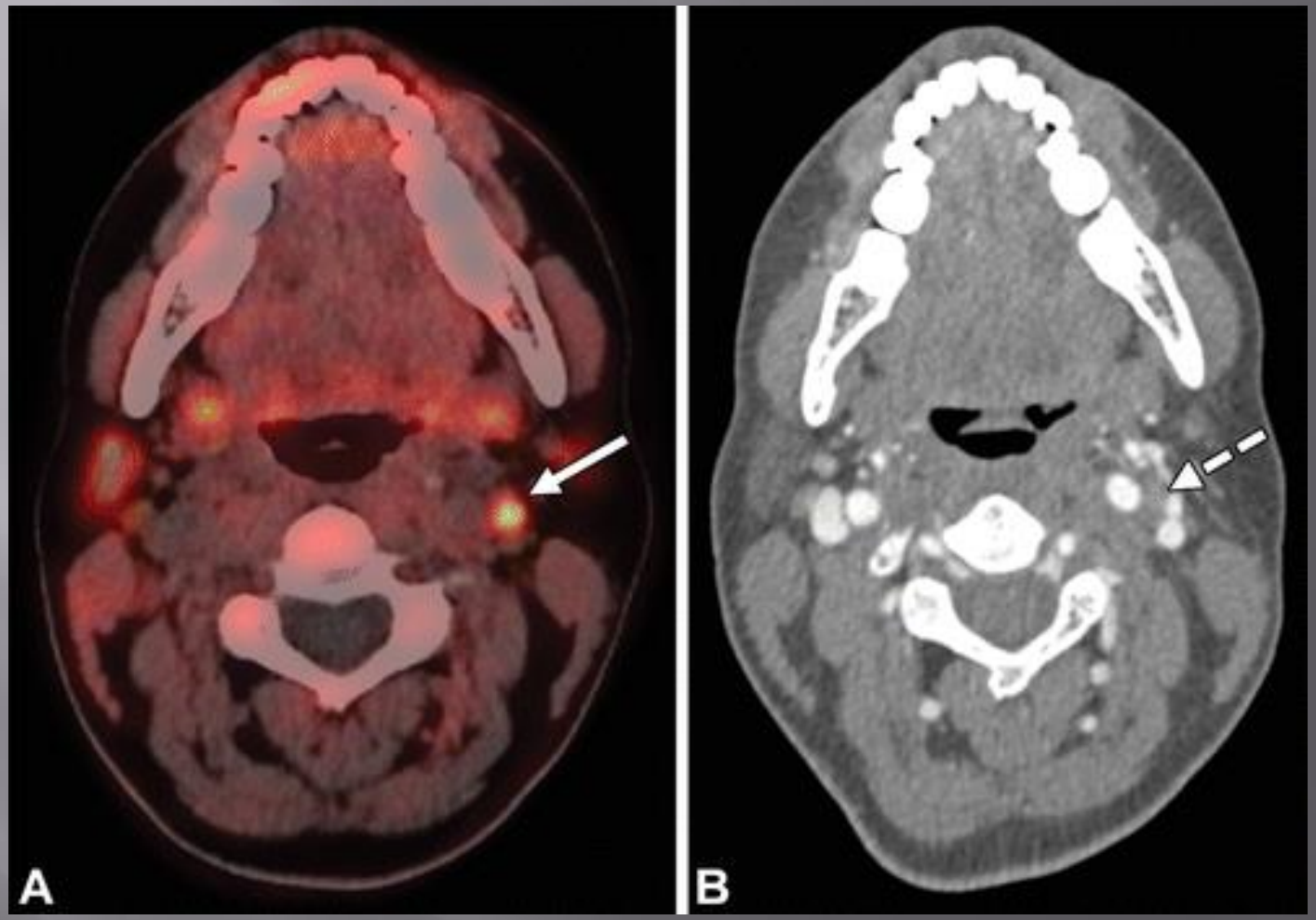
- Ectopic mediastinal adenomas can also be detected more clearly with choline PET/CT, as compared with ^{99m}Tc-sestamibi scanning,
- because the higher photon energies of PET, as compared with the gamma radiation from SPECT, are less attenuated by bone

- Other advantages of choline PET/CT over ^{99m}Tc-sestamibi SPECT/CT include a shorter acquisition time and lower radiation dose
- Limited head-to-head comparisons of 4D CT versus ^{18}F-fluorocholine PET/CT have shown similar or superior sensitivities with PET/CT

- Choline PET radiotracers lack specificity because of their intrinsic pharmacologic properties, and inflammatory, infective, and malignant processes also show uptake
- Benign and malignant thyroid nodules can be choline avid and mimic intrathyroid adenomas.
- Diffuse choline uptake is seen with thyroiditis or Graves disease, concealing intrathyroid adenomas.

- Lymph nodes can cause false-positive results,
- but they may also mask adenomas when they are found adjacent to these parathyroid lesions in clusters (Fig 22).
- Cystic adenomas show reduced uptake and may cause false-negative results.


A
B
C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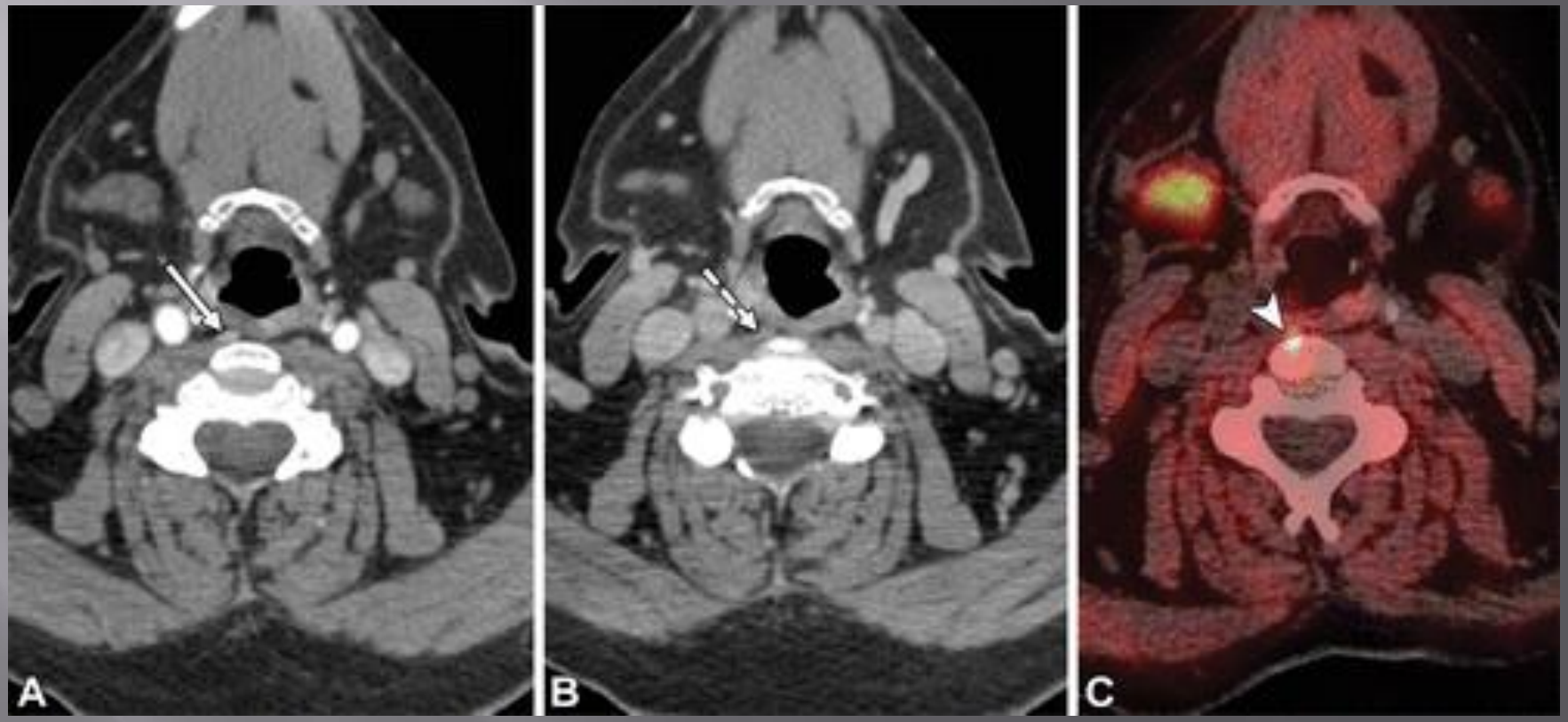
A
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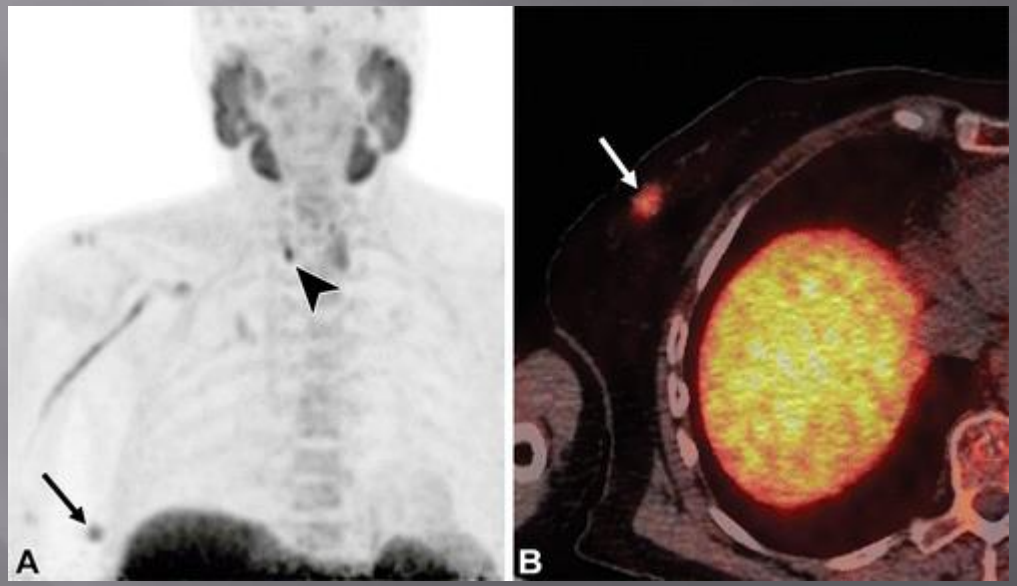
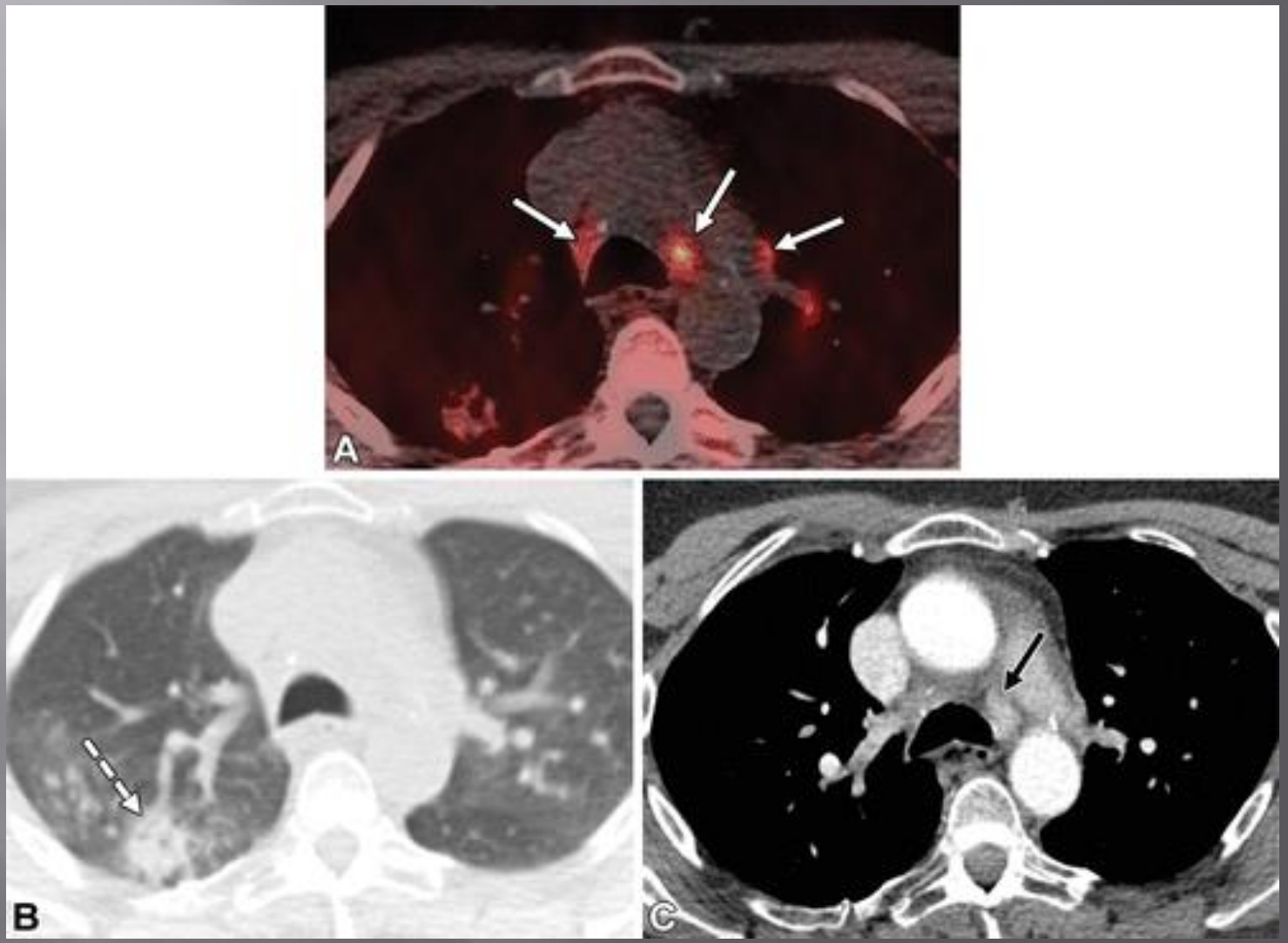

A
B


A
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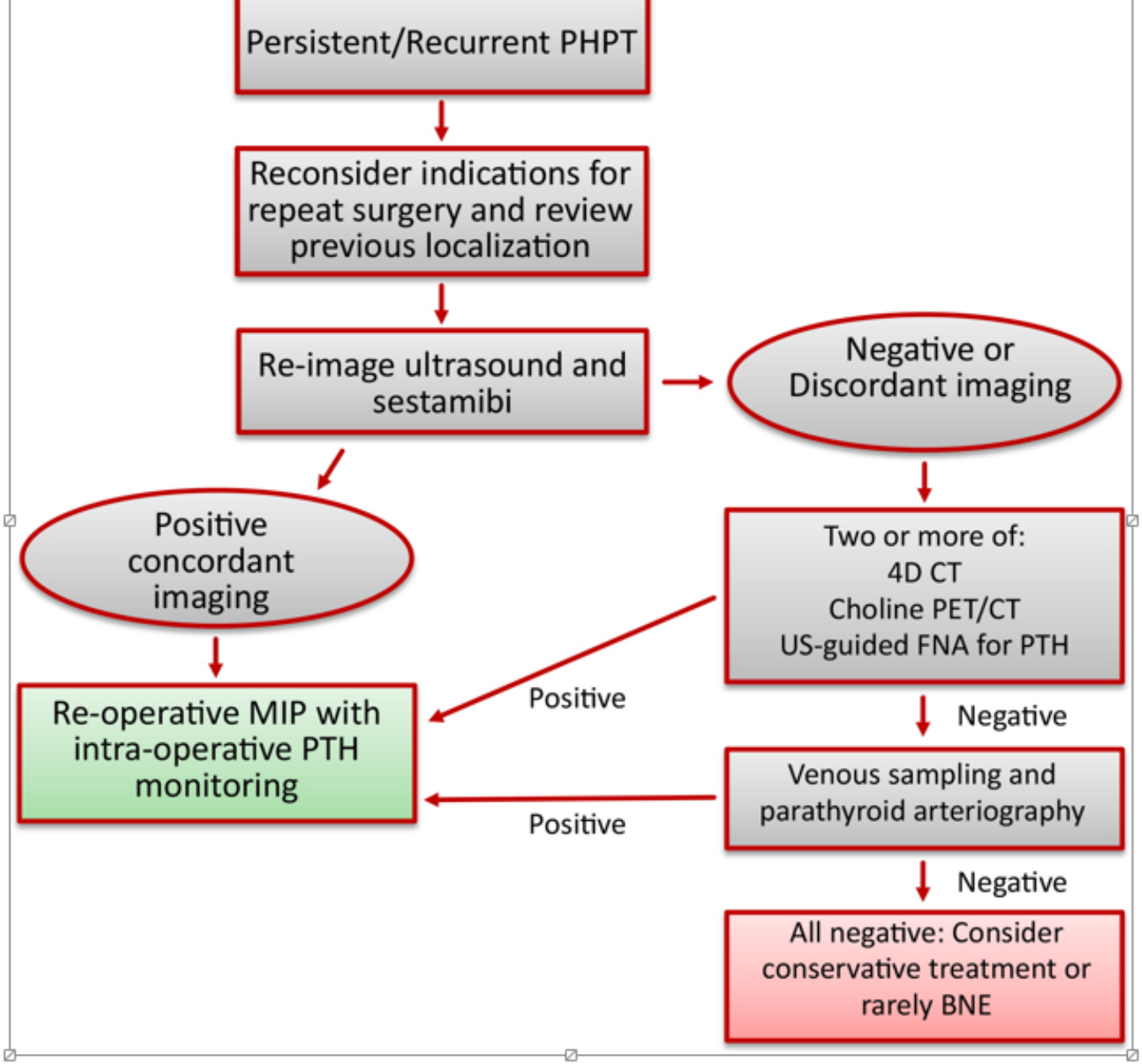
C



calization in patients with persistent or recurrent PHPT who present to the authors' cente

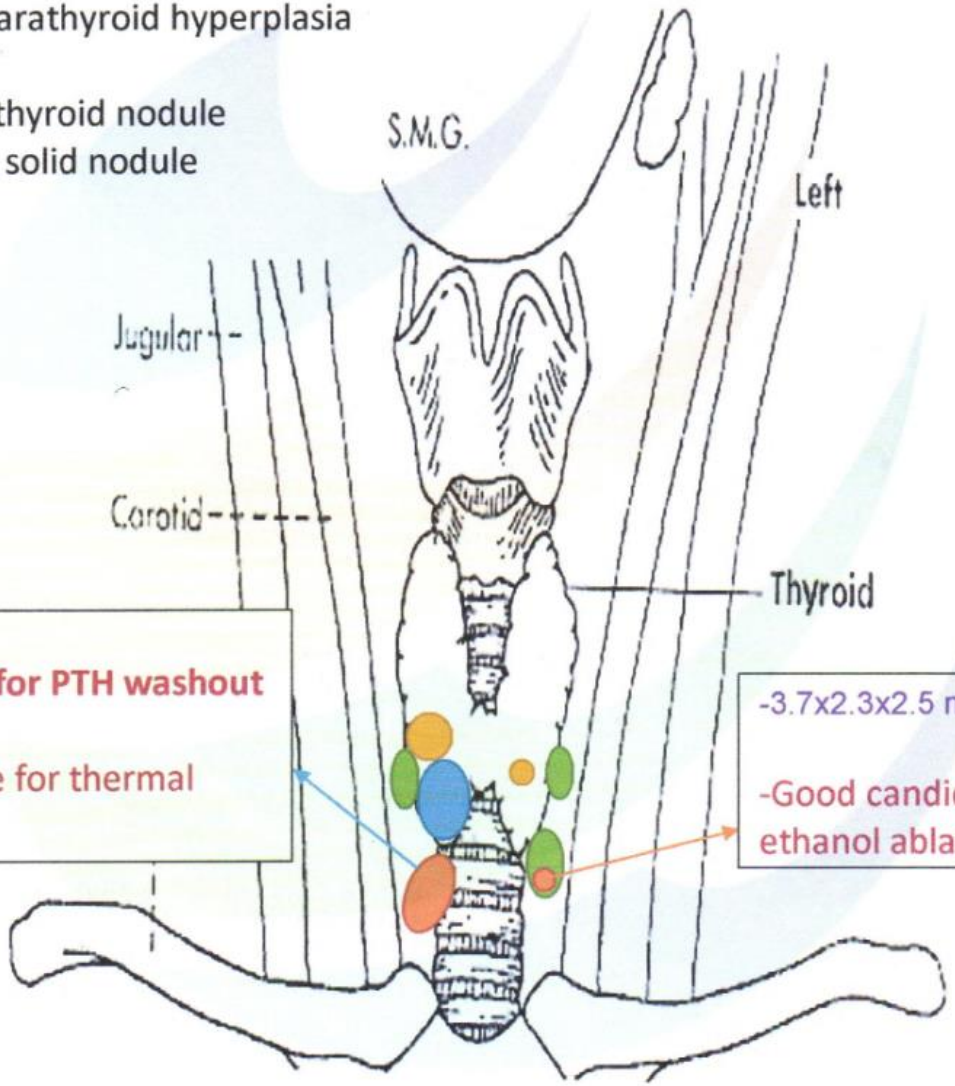
	Inexpensive No radiation Readily available Simultaneous thyroid assessment Majority of glands are eutopic and perithyroid	Operator-dependent interpretation Ectopic blind spots Patient factors: elevated body mass index, kyphosis, large goiter, or other anatomic factors	None
i planar and	Widely available Ease of interpretation Assessment for ectopic glands	Radiation Longer acquisition Cannot assess thyroid Reduced detection of oxyphil-poor adenomas Multigland disease	6.3–7.8 mSv
	Excellent anatomic detail Fast acquisition Ectopic glands Multigland disease	Reporter dependent Irradiation, especially to thyroid Iodinated contrast material Technical artifacts	10.4 mSv for three-phase protocol
	No radiation Ectopic glands	Limited sensitivity Artifact from thoracic inlet and movement Lower spatial resolution than CT (thus difficulty depicting smaller adenomas) Implanted medical devices Longer acquisition time	None
	Improved spatial resolution compared with SPECT Ectopic glands	High cost Lower availability Nonspecificity of tracer uptake	6 mSv for ^{18}F-fluorocholine and ^{11}C-

Hypoechoic mass highly suggestive for parathyroid adenoma

Enlarged parathyroid glands, suggestive for parathyroid hyperplasia

Hypoechoic thyroid nodule

Hyperechoic solid nodule



-5x9x18.5 mm

-FNA was done for PTH washout

-Good candidate for thermal ablation

-3.7x2.3x2.5 mm

-Good candidate for ethanol ablation

Best Regards

ochemistry

	Result	Unit	Normal Range
umin(serum)	4.3	g/dL	3.5 - 5
lcium Serum (Ca)	8.8	mg/dL	8.5-10.5
osphorus(P)	H 5.4*	mg/dL	2.6-4.5

Confirmed by Repeated Analysis H=High

pecial Biochemistry

Test	Result	Unit	Normal Range
5-OH-Vitamin D	10.27	ng/ml	Deficient:.....<10 Insufficient:.....10-30 Sufficient:.....30-100 intoxication:.....>100

Hormone

Test	Result	Unit	Method	Normal Range
Parathyroid Hormone(serum)	22.4	pg/ml	ECL	12-65

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Dr.V. Ostadi
PhD. of Medical Immunology

آزمایشگاه مفید
MOFID LABORATORY
دکتر پردیس نعمت الهی
نظام پزشکی: ۵۷۵۴۰ ن ع:آ- ۱۹۶۴
دکتر مریم السادات میرطالبی
نظام پزشکی: ۱۲۷۳۲۷ ن ع:آ- ۸۰۷۹
دکتر اکرم عابدی
نظام پزشکی: ۱۰۸۴۱۷ ن ع:آ- ۴۰۹۰
دکتر فرزاد سید فروتن
نظام پزشکی: ۶۲۸۷۷ ن ع:آ- ۴۴۶۰

PHY OF NECK FOR EVALUATION OF PARATHYROID ADENOMA:

uation of right side parathyroid glands was done with limitation secondary to large thyroi
le (35x25x60 mm).

ower parathyroid gland is seen with increased diameter, 10.6 x 3 x 8 mm containing
echoic area (in diameter of 3x2.2 mm) and increased vascular flow

hese findings can be suggestive for parathyroid adenoma in this gland

thanol ablation of this gland is an option

per gland is seen in diameter of 6.7 x 3 x 4 mm

Best Regards

Dr. Mohammad Nilchian

SPECT-CT

Parathyroid SCINTIGRAPHY

Procedure:

15, 60 and 120 minutes after IV injection of 740 MBq Tc-99m sestamibi, the study was performed from anterior neck and mediastinum. Spect-CT image obtain 60 minute after injection as well.

Description:

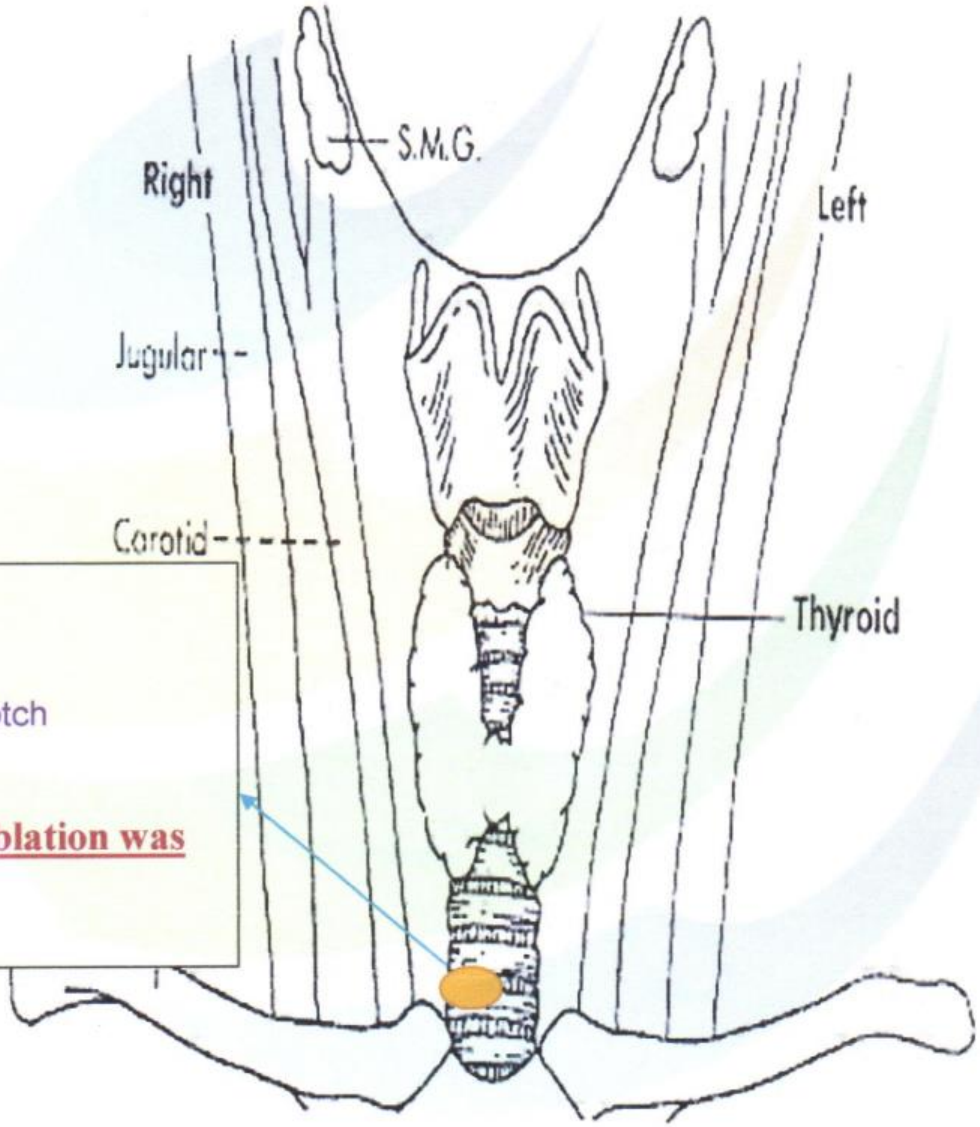
Imaging at 15 minutes shows bilateral thyroidal uptake with no focal uptake. On delayed images complete radiotracer washout is noted. No focus of radiotracer retention is noted on late views.

Interpretation:

- ***The study is negative for parathyroid adenoma.***

Note: *Parathyroid Scintigraphy is not sensitive for detection of parathyroid*

Parathyroid adenoma



16.5x7x14 mm

suprasternal notch

Microwave ablation was

lone

Best Regards

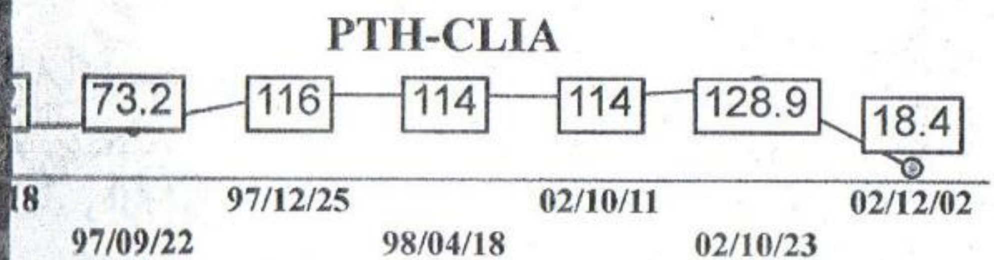
کن...

ی بدیعی　　سن: ۸۴ سال　　نام پزشک : جناب آقای دکتر محمد نیل چیان

تاریخ پذیرش: ۱۴۰۲/۱۲/۰۲　　سابقه : ۱۸　　صفحه: ۲ از ۲

ndocrinology & Immunodiagnostics

Test	Risk	Result	Unit	Reference(
PTH-CLIA		18.4	Pg/mL	15.0-65.0



I. R. Azizi

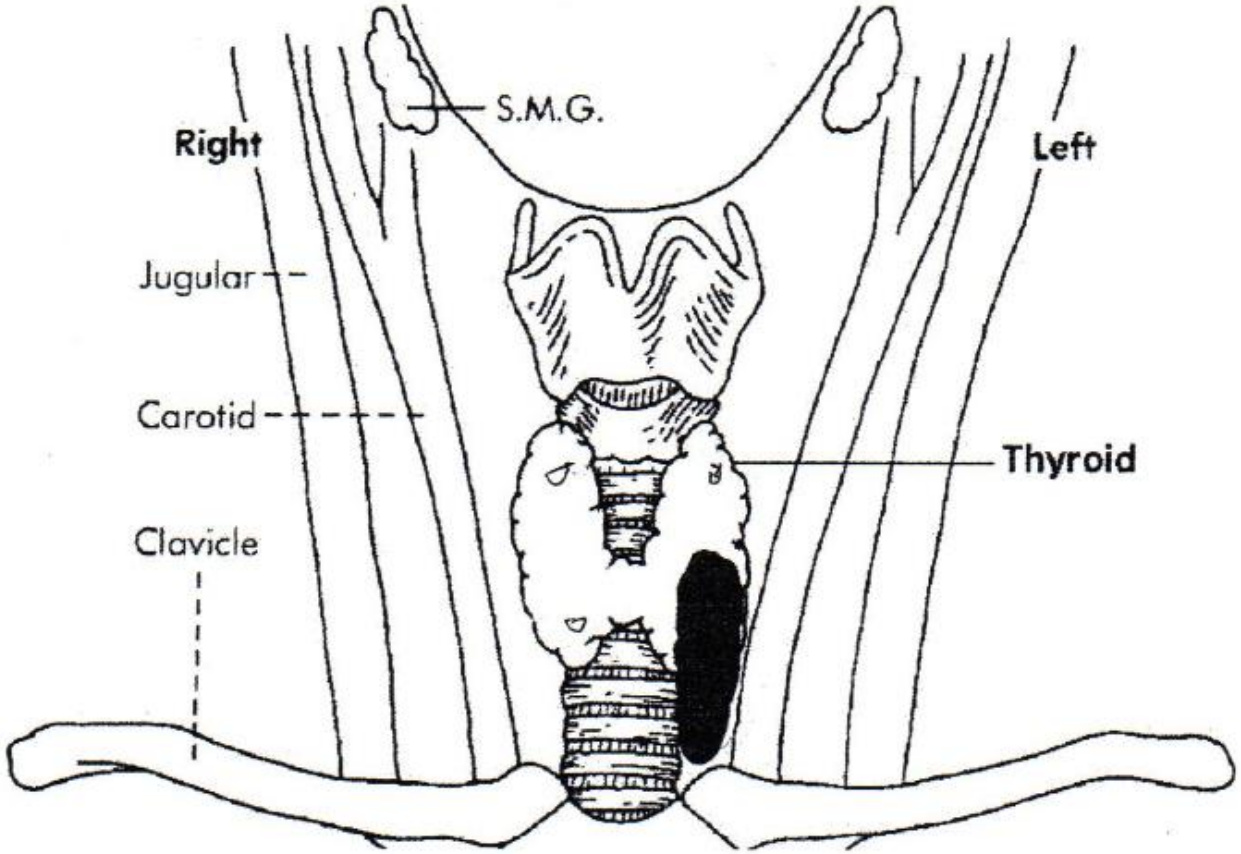
Dr. M. Vahid
DCLS

Dr. Sh. Kouhpayeh
PhD. in Clinical immunology

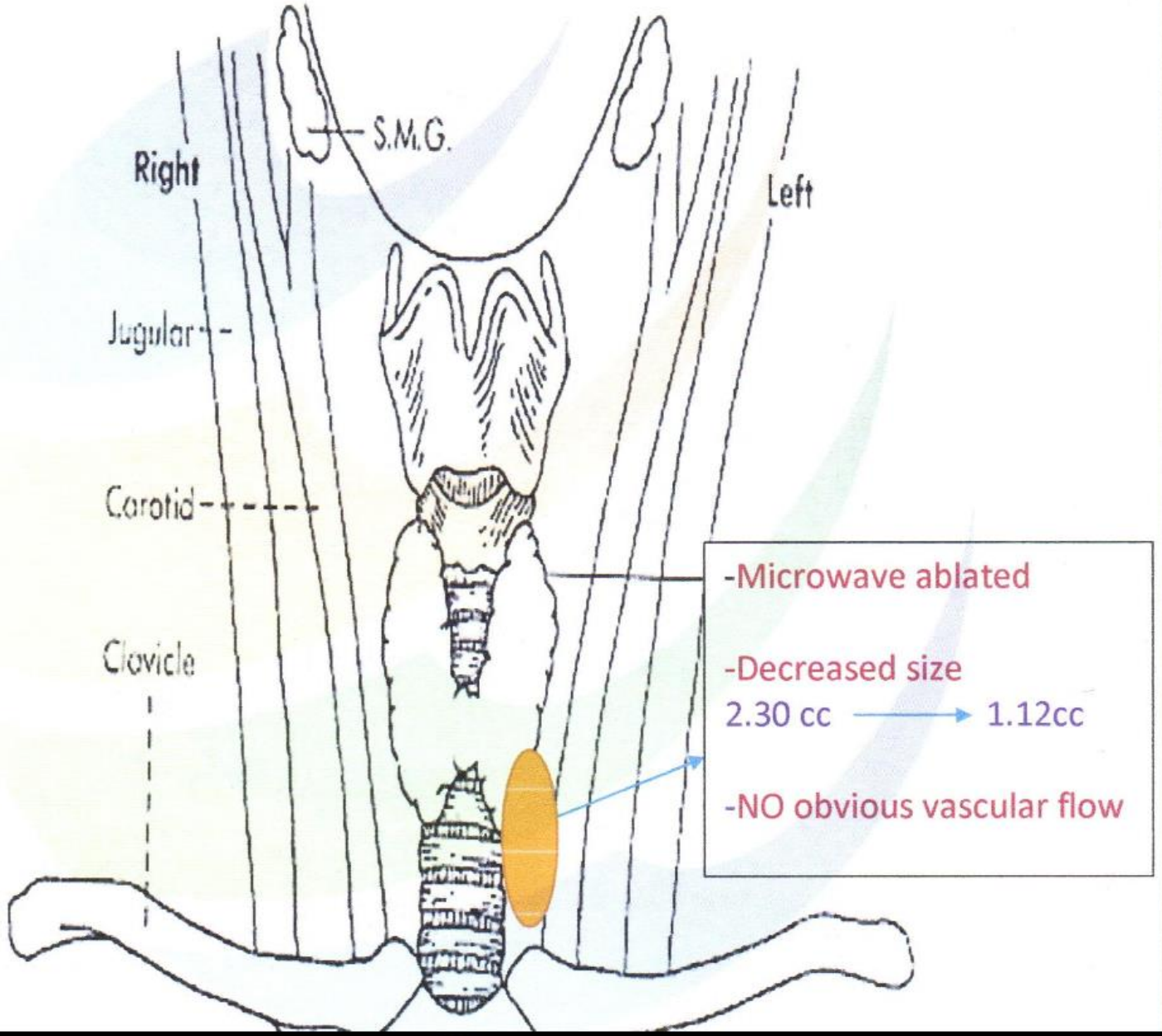
Dr. M. Reisi Far
MD. AP

دکتر محمدرضا عزیزی
نظام پزشکی ع.آ. ۱۰۵۰
دکتر محمد وحید
نظام پزشکی ع.آ. ۱۰۸۷
دکتر ملک رئیسی فر
نظام پزشکی ۲۰۸۳۳
دکتر شیرین کوهپایه
نظام پزشکی آ.۳۰۸۰

roinferior to the left lobe of the thyroid: 33 x 12 x 11 mm, 2.3 cc



Parathyroid adenoma



شمـــاره پذیرش : ۶۰۰۲-۹۰ کد ملی :۱۲۸۷۶۱۶۱۶۱ تاریخ پذیرش : ۱۴۰۲/۰۹/۲۷ پزشک معالج : جناب آقای دکتر محمد نیل چیان ۳۱
نام مراجعه کننده : خانم بتول روانفر سن : ۷۱ سال تاریخ نمونه گیری : تاریخ پذیرش ص: ۱ از ۱

Hormone

Test		Result	Unit	Method	Normal Range
Parathyroid Hormone(PTH)	H	133.7	pg/ml	ECL	12-65

H=High

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آزمایشگاه مفید
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نظام پزشکی: ۵۷۹۴۰ ن ع:آ-۱۹۶۳
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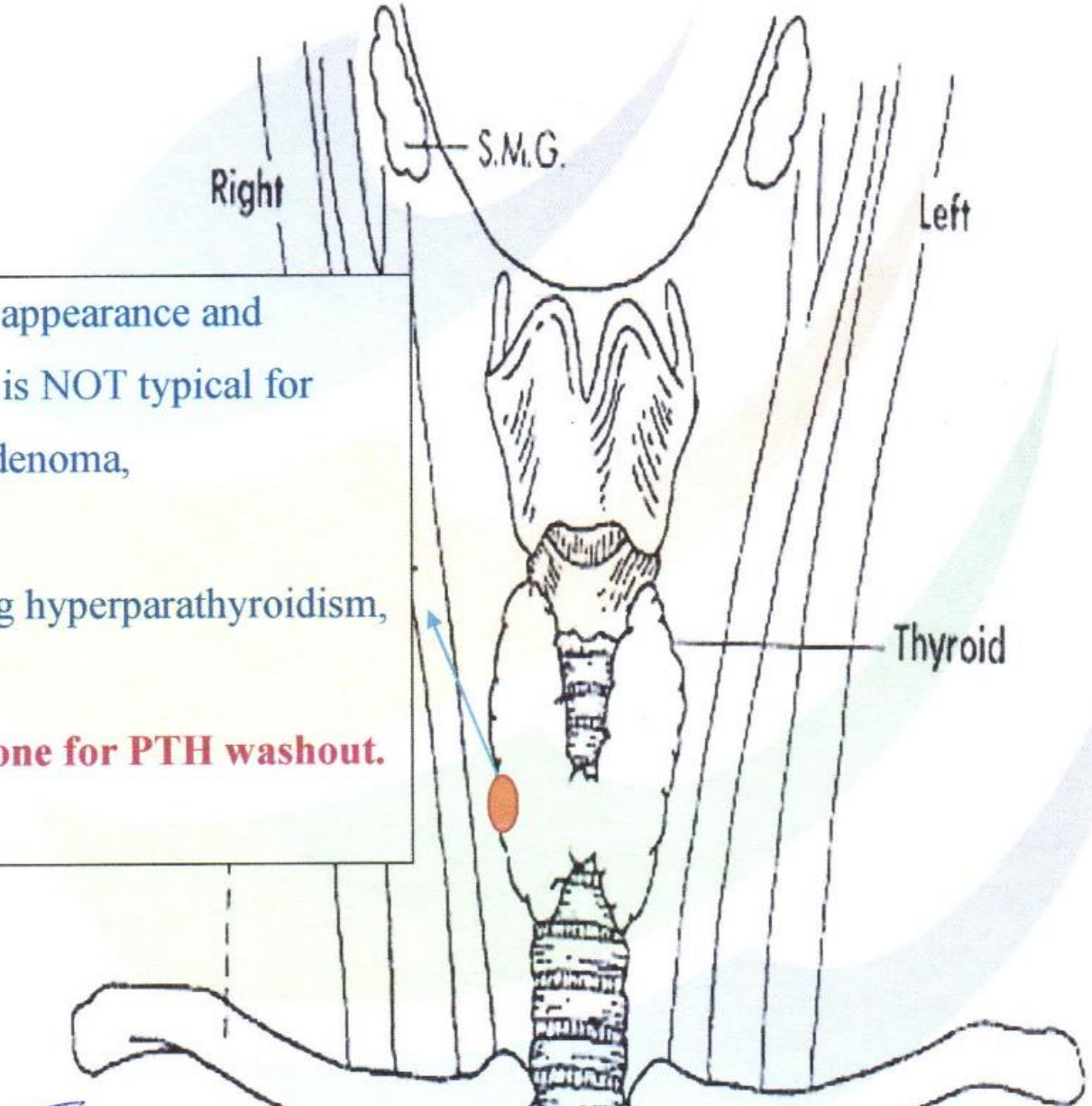
دکتر اکرم عابدی
نظام پزشکی: ۱۰۸۴۱۷ ن ع:آ-۴۰۹۰
دکتر فرزاد سید فروتن
نظام پزشکی: ۶۲۸۷۷ ن ع:آ-۴۴۶۰
دکتر وجیهه استادی
ن ع:آ-۴۹۹۴

-Sonographic appearance and vascular flow is NOT typical for parathyroid adenoma,

-but regarding hyperparathyroidism,

-FNA was done for PTH washout.



AND SONOGRAPHY OF THYROID AND NECK:

Thyroid lobes and isthmus have normal size, parenchymal echopattern and vascular flow.

- RL= 46x16x12 mm RL volume= 5 cc
- LL= 39x14.5x10 mm LL volume = 3 cc
- AP diameter of isthmus = 3 mm

There is NO evidence of cystic or solid thyroid nodule.

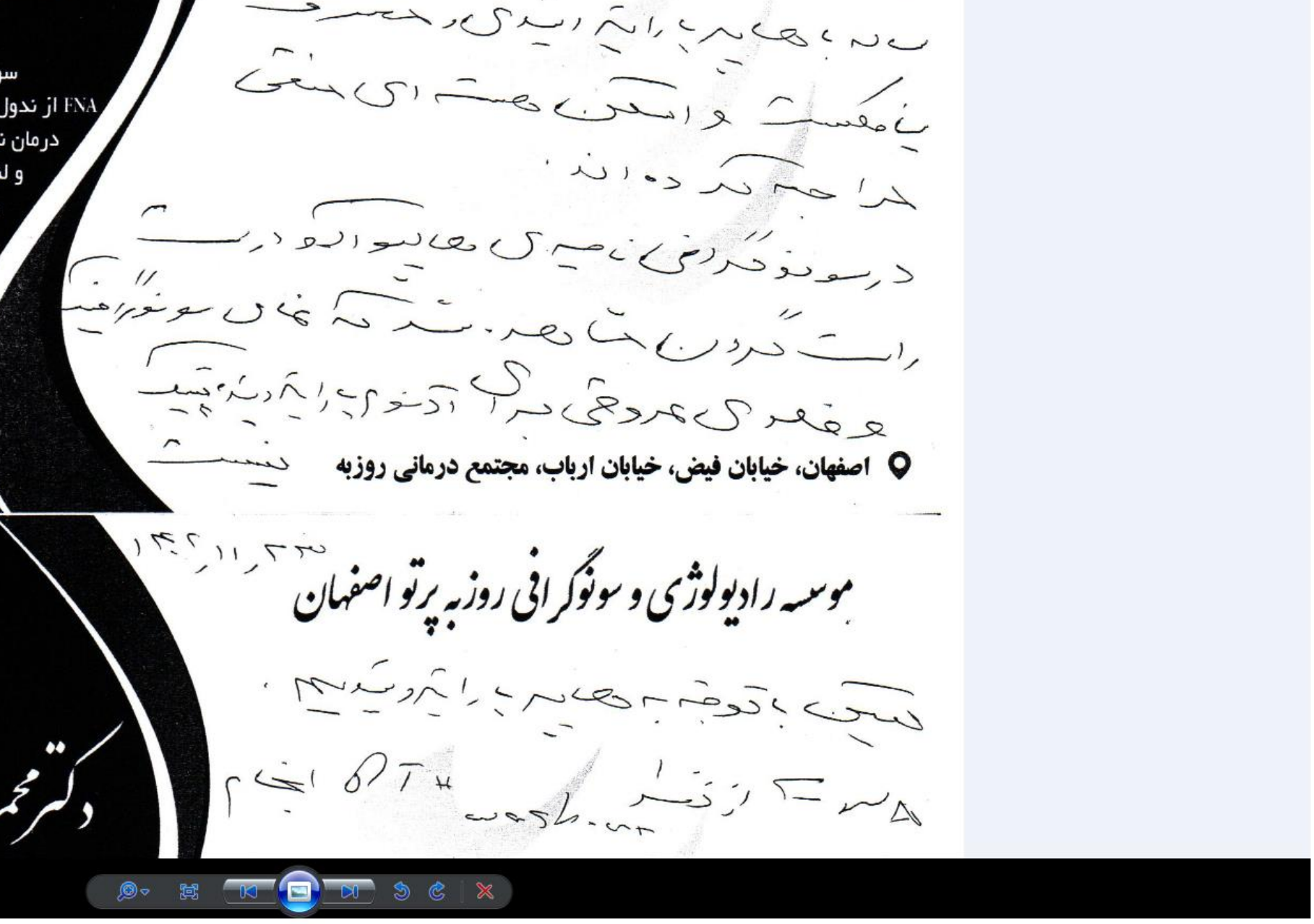
A hypoechoic area in diameter of 4.5x3x9.5 mm is seen posterior-inferior to right thyroid lobe.

Sonographic appearance and vascular flow is NOT typical for parathyroid adenoma, but regarding hyperparathyroidism, **FNA was done for PTH washout.**

LAP is not detected.

Best Regards

Dr. Mohammad Nilchian


اصفهان، خیابان فیض، خیابان ارباب، مجتمع درمانی روزبه
موسسه رادیولوژی و سونوگرافی روزبه پرتو اصفهان

دکتر محمد نیلچیان
متخصص رادیولوژی و سونوگرافی
دارای بورد تخصصی
سونوگرافی تخصصی تیروئید
FNA از ندول های تیروئید و لنف نود های
درمان ندول های تیروئید و پاراتیروئید
و لنف نودهای ثانویه به کانسر
با روش های غیر جراحی
۳۶۶۴۳۰۱۹ –
۳۶۶۱۹۲۶۷ –

۱۴۰۲/۱۱/۲۳

موسسه رادیولوژی و سونوگرافی روزبه پرتو اصفهان

بیمار با توجه به حجم زیاد تیروئید،
۵ سی سی از تزریق ETH ablation انجام
شد و ۳۵۰ : به ETH ablation
می‌رسد.
بیمار، نیاز به [illegible] جهت ETH ablation
بعدی [illegible] سونوگرافی به شکل
آدنوم پاراتیروئید نیست ablation [illegible]
توصیه می‌شود و سونوگرافی فالوآپ توصیه
می‌شود.

دکتر محمد نیلچیان
متخصص رادیولوژی - دارای بورد تخصصی
سونوگرافی تخصصی و نمونه برداری تیروئید
نمونه برداری و کاتترگذاری
نظام پزشکی ۱۴۱۹۱۵

اصفهان، خیابان فیض، خیابان ارباب، مجتمع درمانی

پذیرش : ۱۱-۱۷۳۹ کد ملی :۳۶۲۱۴۲۷۹۵۳ تاریخ پذیرش : ۱۴۰۲/۱۱/۱۷ پزشک معالج : جناب آقای دکتر محمد نیل
ه کننده : آقای جواد هزاره مقدم سن : ۴۱ سال تاریخ نمونه گیری : تاریخ پذیرش

	Result	Unit	Method	Normal Range
NWashout) . .H	350.8	pg/ml	ECL	< 100: suggestive the biopsy site do contain PTH-secreting tissue >=100: suggestive of the presence PTH-secreting tissue

tollahi
topathology

Dr.F.S. Forootan
MD,PhD. Medical Genetics

Dr.A. Abedi
Fellowship of hematopatholo

Dr.V. Ostadi
PhD. of Medical Immunology

دکتر پو
نظام پزشکی:
دکتر مریم
نظام پزشکی

همکار گرامی امیررضا نومریان ۵۸۰۳۲

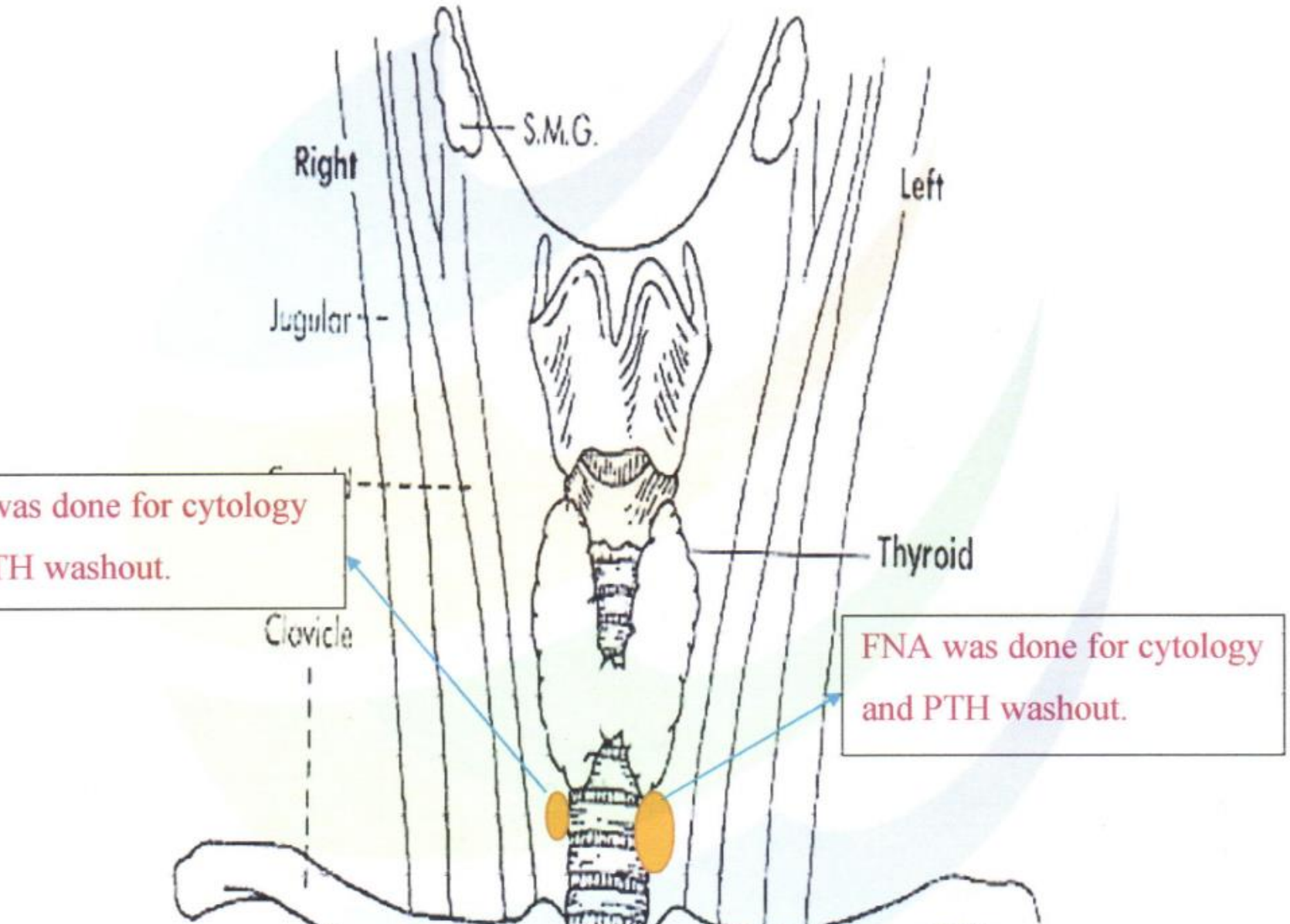
باعرض سلام واحترام

سونوگرافی تیروئید و بافت نرم گردن دو طرف :(MAPPING)

تصویر توده بیضی شکل هیپواکوئیک هیپرواسکولار با تغییرات کیستک باابعاد 5mm
ناحیه پاراتراکئال چپ لترال به مری مطرح کننده آدنوم پاراتیروئید مشهود است.
لوب های تیروئید حجم ، شکل ، حدود و اکوپترن طبیعی دارند.
تصویر ندولspongiform ایزواکوئیک با ابعاد 5x3mm در پل میانی تحتانی لوب
در بررسی زنجیره لنفاتیک گردنی آدنوپاتی پاتولوژیک و یا مثبت Definite دیده

آقای رجبعلی شریفی ولدانی ۱۴۰۲/۰۹/۲۲

Hypoechoic masses, suspicious for parathyroid adenoma



HY OF NECK FOR EVALUATION OF PARATHYROID ADENOMA:

echoic mass with regular border and vascular flow in diameter of 12.5x6.5x20 mm is seen,
or-inferior to left lobe of thyroid.

was done for cytology and PTH washout.

echoic mass with regular border and vascular flow in diameter of 6x8x13.5 mm is seen
or-inferior to right lobe of thyroid.

was done for cytology and PTH washout.

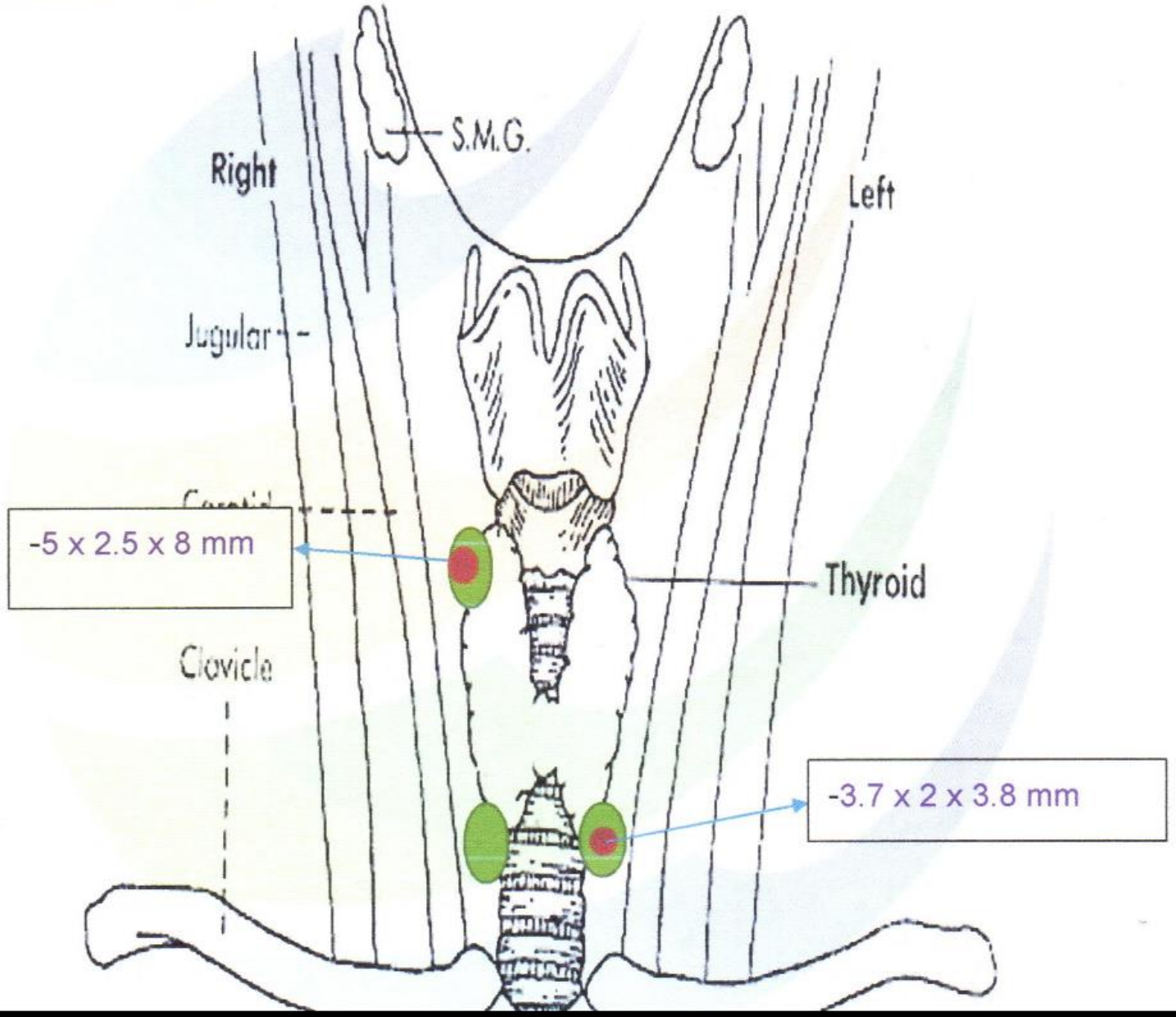
not detected.

Best Regards

Dr. Mohammad Nilchian

nlarged parathyroid gland, suggestive for parathyroid hyperplasia

rathyroid adenoma



NOGRAPHY OF NECK FOR EVALUATION OF PARATHYROID GLANDS:

1. Parathyroid glands are seen with increased size and normal parenchymal echopattern suggestive for parathyroid hyperplasia.
   - Left lower parathyroid gland: 8.6x6.5x6.5 mm
   - Right upper parathyroid gland: 12.5x4x6 mm
   - Right lower parathyroid gland: 8.5x4.5x5 mm
2. A hypoechoic mass in diameter of 3.7x2x3.8 mm is seen in left lower parathyroid gland, **highly suggestive for parathyroid adenoma.**
3. A hypoechoic mass in diameter of 5x2.5x8 mm is seen in right upper parathyroid gland, **highly suggestive for parathyroid adenoma.**

Best Regards

Dr. Mohammad Nilchian

ration	32.6	mL/min/1.	Stage G1≥90 Stage G2: 60-89 Stage G3a: 45-59 Stage G3b: 30-44 Stage G4: 15-29 Stage G5: <15
H	10.6*	mg/dL	8.5-10.5
	4.3	mg/dL	2.6-4.5
	142	U/L	64-306
	422	U/L	<530
	4.7	g/dL	3.5-5.0
	84	µg/dL	39-149
	266	µg/dL	250-450
	213	mg/dl	200-360
tion	31.6	%	20-50

تاریخ پذیرش: ۱۴۰۲/۱۱/۲۰

شماره پذیرش: ۱۵۱۵۶۲

ecific Clinical Chemistry;HPLC

est	Risk	Result	Unit	Reference(Based on Sex/Age)
itamin. D3;25 OH. holecalciferol; HPLC		57.53	ng/mL	Deficient <10 Insufficient 10-29 Sufficient 30-100 Potential Intoxication >100

docrinology & Immunodiagnostics

est	Risk	Result	Unit	Reference(Based on Sex/Age)
SH. CLIA		1.570	µIU/mL	0.5-5.5

A lot of preanalytical variable such as Drugs(Metformin,Steroids,NSAIDs,OCP,Anti-depressant,Lithium,Inorganic Iodides,…),Stress, Hospitalization,Pregnancy,Long fasting,Exercise,Inflammation, Menstruation,… cause prominent variation in serum TSH level;for more information review-TSH pitfall in www.erythron-lab.com.

TH-CLIA	H	106.2	Pg/mL	15.0-65.0
erritin-ECLIA		162.46	ng/mL	Premenopause: 10-100 postmenopause: 20-200

اصفهان، خیابان شیخ صدوق شمالی، خیابان شیخ مفید ۷۰ - ۳۶۶۳۱۹۰۶ ۲۲ - ۳۶۶۳۳۶۲۱

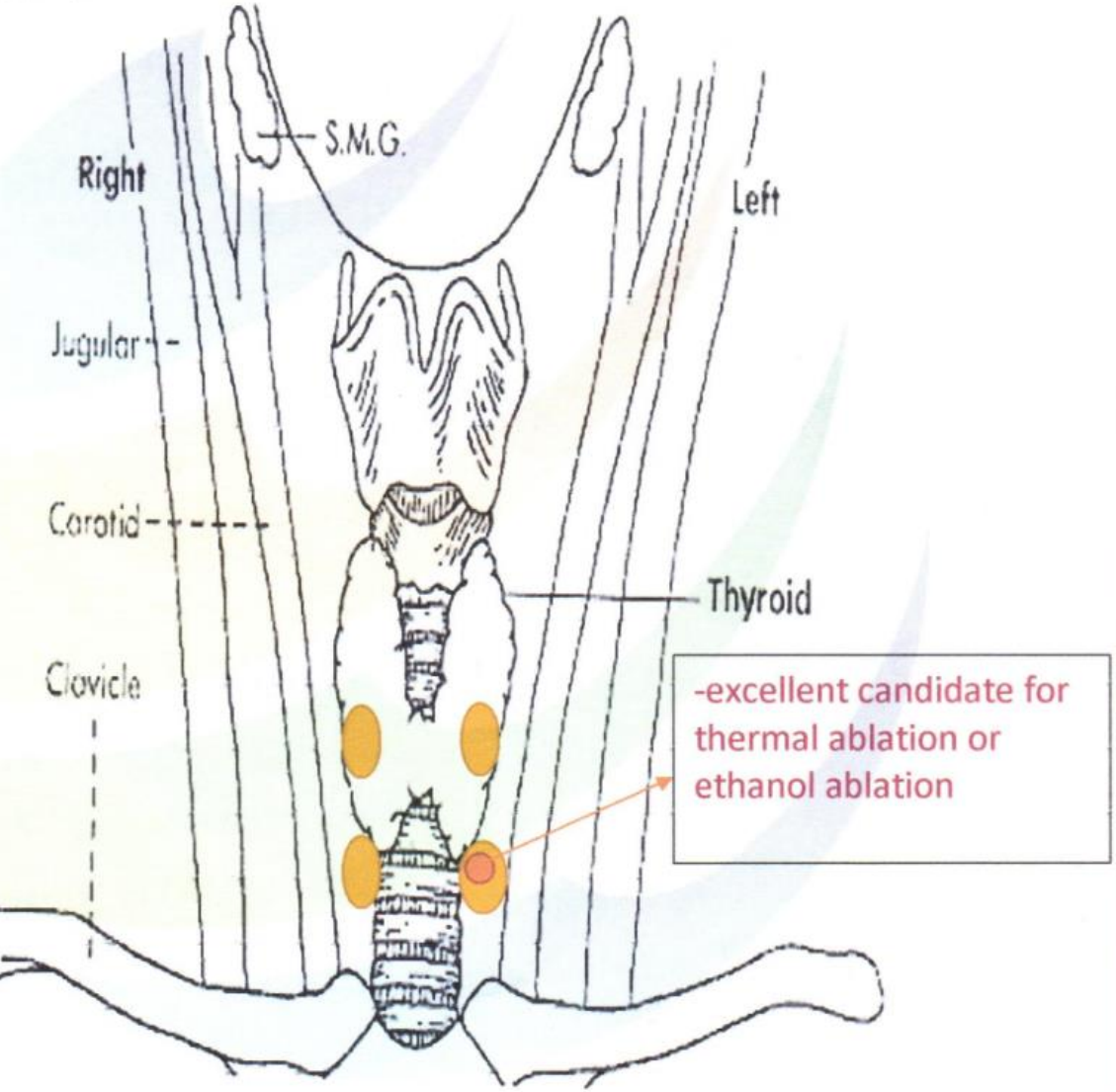
n the neck and reachable upper mediastinum. All lymph

pattern. They have anatomic vessels in Doppler survey.

6 cc hypoechoic lesion with moderate vascularity

e right thyroid lobe. The features are suggestive of

noma


S.M.G.
Right
Left
Jugular
Carotid
Thyroid
Clavicle
-excellent candidate for thermal ablation or ethanol ablation

The thyroid lobes and isthmus have normal size, parenchymal echopattern & vascular flow.

- RL= 50x16x12 mm RL volume= 5.5 cc
- LL= 49x17x13 mm LL volume = 5.5 cc
- AP diameter of isthmus = 2.5 mm

There is NO solid or cystic nodule

Parotid glands are seen with increased size, suggestive for parathyroid hyperpla

Right upper gland: 8x3x7.5 mm

Right lower gland: 9x4.5x7 mm

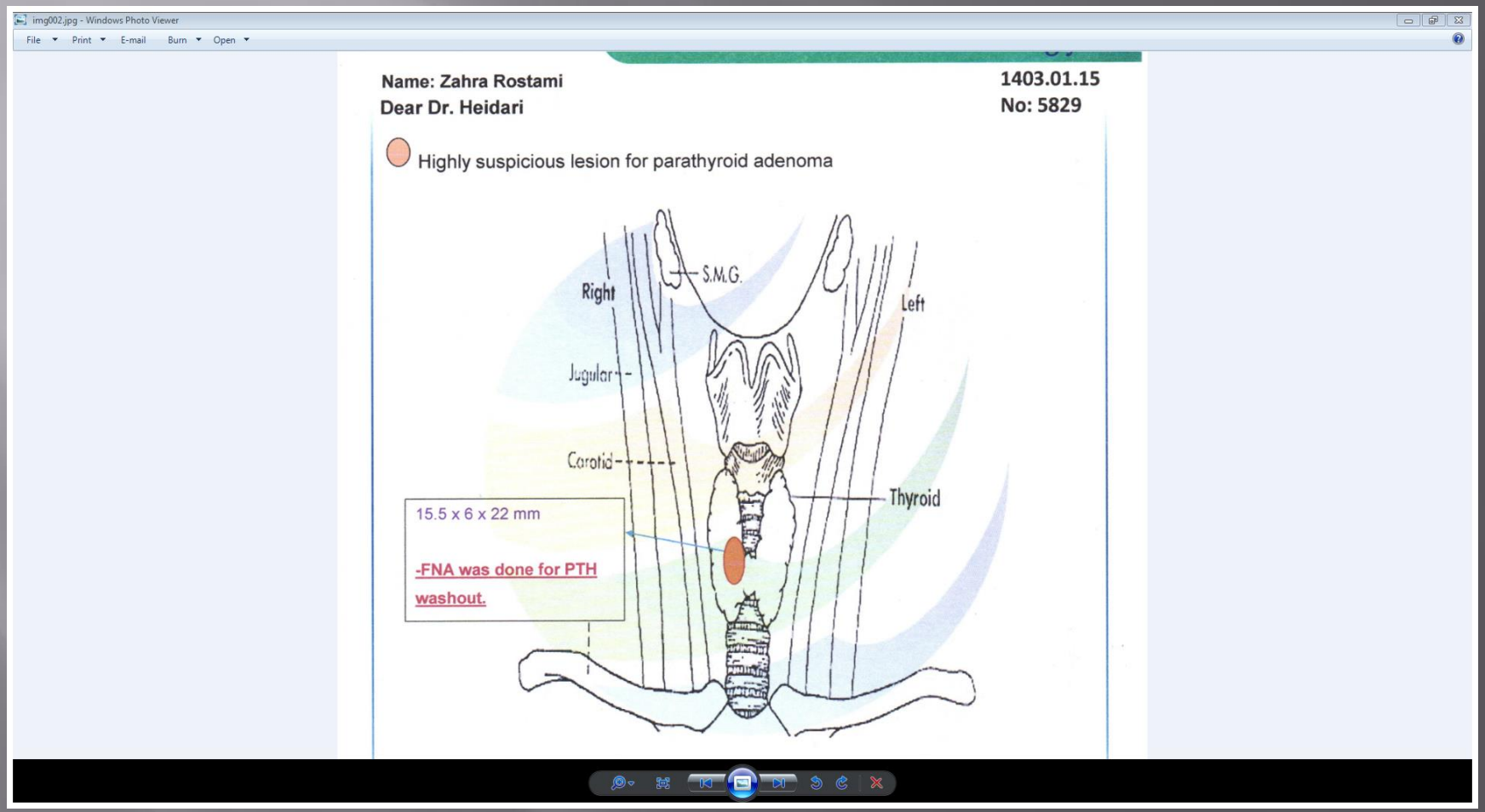
Left upper gland: 8.5x4x7 mm

Left lower gland: 6.5x5x12 mm

A hypoechoic mass with regular border and internal vascular flow in diameter of 4x2.5x4.7 mm is seen **in left lower parathyroid gland, highly suggestive for parathyroid adenoma**.

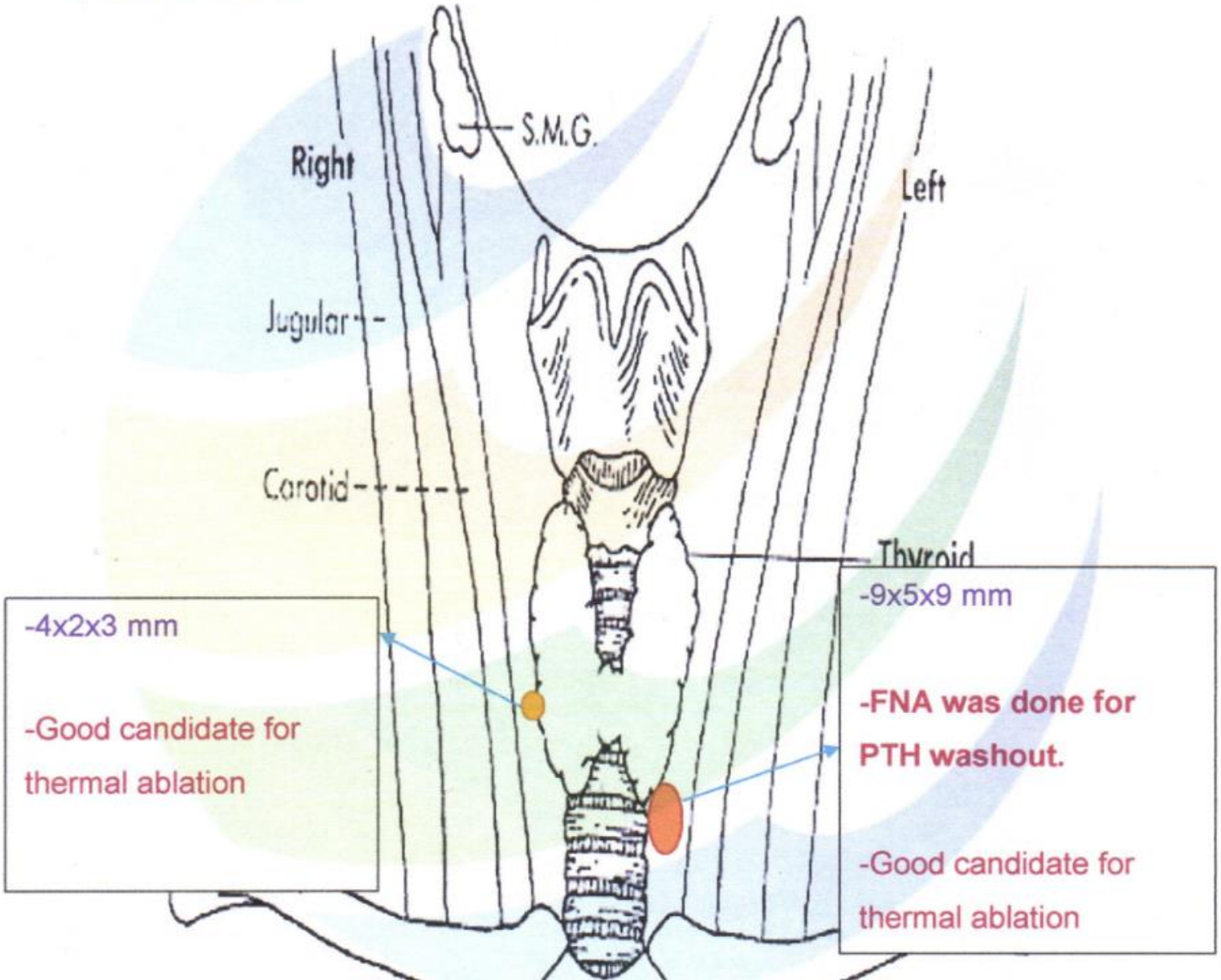
LAP is not detected.

Scan w/o us

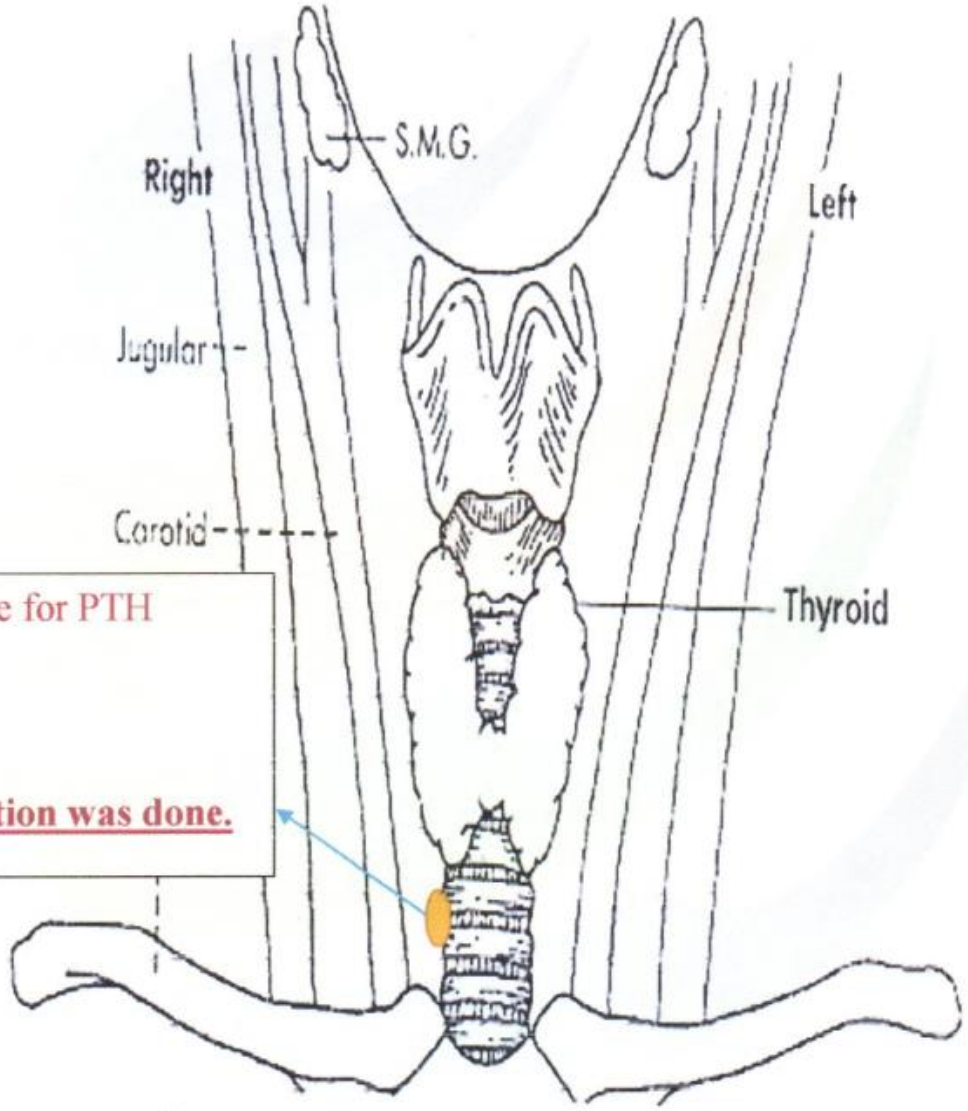

img002.jpg - Windows Photo Viewer
File Print E-mail Burn Open
Name: Zahra Rostami
1403.01.15
Dear Dr. Heidari
No: 5829
Highly suspicious lesion for parathyroid adenoma
S.M.G.
Right
Left
Jugular
Carotid
Thyroid
15.5 x 6 x 22 mm
-FNA was done for PTH washout.

Highly suspicious lesion for parathyroid adenoma

Parathyroid adenoma



- Hypoechoic mass, highly suspicious for parathyroid adenoma



- FNA was done for PTH washout.

- **Ethanol ablation was done.**

FNA & SONOGRAPHY OF NECK FOR EVALUATION OF PARATHYROID GLANDS:

1. An oval shape hypoechoic mass with internal vascular flow in diameter of 6x5.2x9 mm is seen, posterior and inferior to right lobe of thyroid and lateral to esophagus. Parathyroid adenoma and normal lymph node are in DDX.

FNA was done for PTH washout.

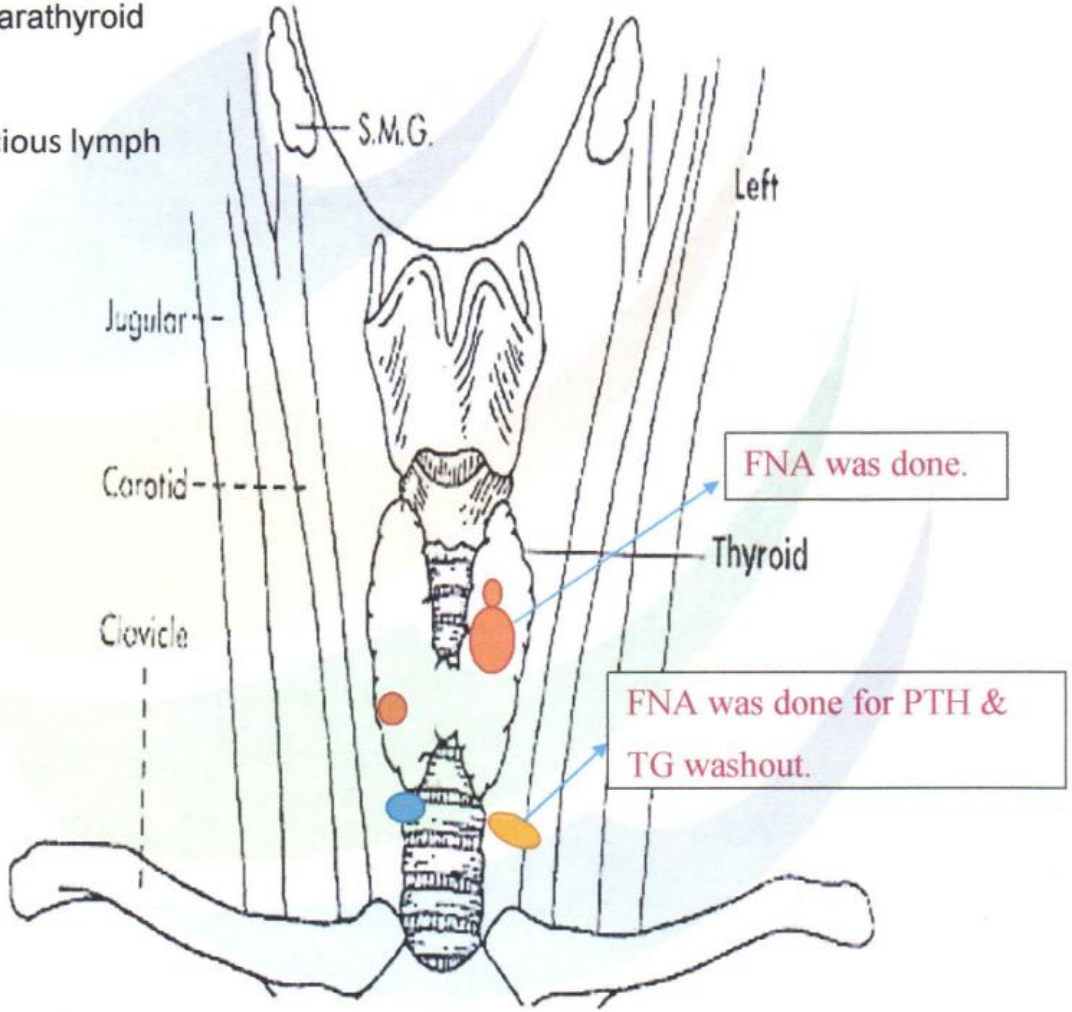
Best Regards

Dr. Mohammad Nilchian

Isoechoic solid nodule with wall calcification & punctate microcalcification foci

Hypoechoic mass, suspicious for parathyroid denoma

Mildly suspicious lymph node



Best Regards

Dr. Mohammad Nilchian

FNA AND SONOGRAPHY OF THYROID AND NECK:

1. The thyroid lobes and isthmus have normal size & parenchymal echopattern.
   - RL= 48x17.5x14 mm RL volume= 6.5 cc
   - LL= 45x19x11 mm LL volume = 5 cc
   - AP diameter of isthmus = 4 mm
2. An isoechoic solid nodule with regular border, wall calcification & punctate microcalcification foci in diameter of 10x8x15 mm is seen in middle part of left lobe.

   (ATA: Intermediate suspicion ACR-TIRADS: Highly suspicious, V)

   FNA was done.

- A similar nodule in diameter of 3 mm is seen, superior to mentioned nodule.
- A similar nodule in diameter of 4.6x4.2x4.5 mm is seen in lower part of right lobe.

3. A hypoechoic mass with regular border, vascular flow & NO calcification in diameter of 7x7x16mm is seen posterior-inferior to left lobe of thyroid, anterolateral to esophagus, **suspicious for parathyroid adenoma.** suspicious lymph node is in DDX.

   FNA was done for PTH & TG washout.

4. A hypoechoic mass with NO obvious vascular flow or calcification in diameter of 7.5x4.5 mm is seen posterior-inferior to right lobe, **suggestive for mildly suspicious lymph node.**
5. Parotid and submandibular glands have normal appearance.

SPECT-CT
Parathyroid Scintigraphy

Procedure:

15, 60 and 120 minutes after IV injection of 740 MBq Tc-99m sestamibi, the study was performed from anterior neck and mediastinum. Spect-CT image obtain 60 minute after injection as well.

Description:

Imaging at 15 minutes shows bilateral thyroidal uptake with no focal uptake. On delayed images complete radiotracer washout is noted. No focus of radiotracer retention is noted on late views.

Interpretation:

The study is negative for parathyroid adenoma.

**Parathyroid scan is not sensitive for evaluation of parathyroid hyperplasia.*

Yours Sincerely
Nuclear physician

با سلام و احترام

- توده هایپواکو به دیامتر 7x7x16 mm در سمت چپ گردن مشاهده می شود که مشکوک به آدنوم پاراتیروئید می باشد (PTH serum: 102) لنف نود مشکوک در تشیخص افتراقی قرار دارد.
- FNA جهت بررسی PTH & TG washout انجام شد.
- در گزارش آزمایشگاه، PTH washout و TG washout هر دو مثبت می باشند.
- نمای سونوگرافیک بیشتر به نفع آدنوم پاراتیروئید می باشد (سوزن نمونه برداری در مسیر رسیدن به توده فوق از بافت تیروئید رد شده است که این مسئله می تواند باعث مثبت شدن کاذب TG washout بشود) ، لیکن نمی توان لنف نود مشکوک را R/O کرد.
- با توجه به اینکه به هر حال، plan درمان جراحی می باشد، نیاز به اقدام تشخیصی اضافه تری نیست.

با تقدیم احترام

دکتر محمد نیلچیان

Totall Thyroidectomy&left parathyroidectomy &central neck lymphnodectomy

NoI: labeled as total thyroidectomy

focus Tumor focality:two
Tumor site: Left lobe and right
Tumor size : tumor size in left lobe centimeters: 1.5cm and in right lobe:0.3 cm
Histologic tumor type:papillary carcinoma
Tumor Necrosis: Abscent
Vascular invasion: Abscent
Capsular invasion:Abscent
Extra thyroid extension: Can not be assessed

Distance metastasis:Can not be assessed (Mx

pTNM classification (AJCC 8th Edition
TNM staging:T 1 N x Mx ,satge : (I)

pT category: 1 .5 cm (T1)

p M category: Can not be determined from submitted specimen.(Mx)
NoII: Left parathyroid adenoma

:NoIII: central neck lymphnodectomy
N x) :labeled as central lymph nodes ,specimen completely submitted include fibro-vascular tissue and lymph node)
(was not find :(Nx

Additional findings

Hashimoto thyroiditis in both lobes

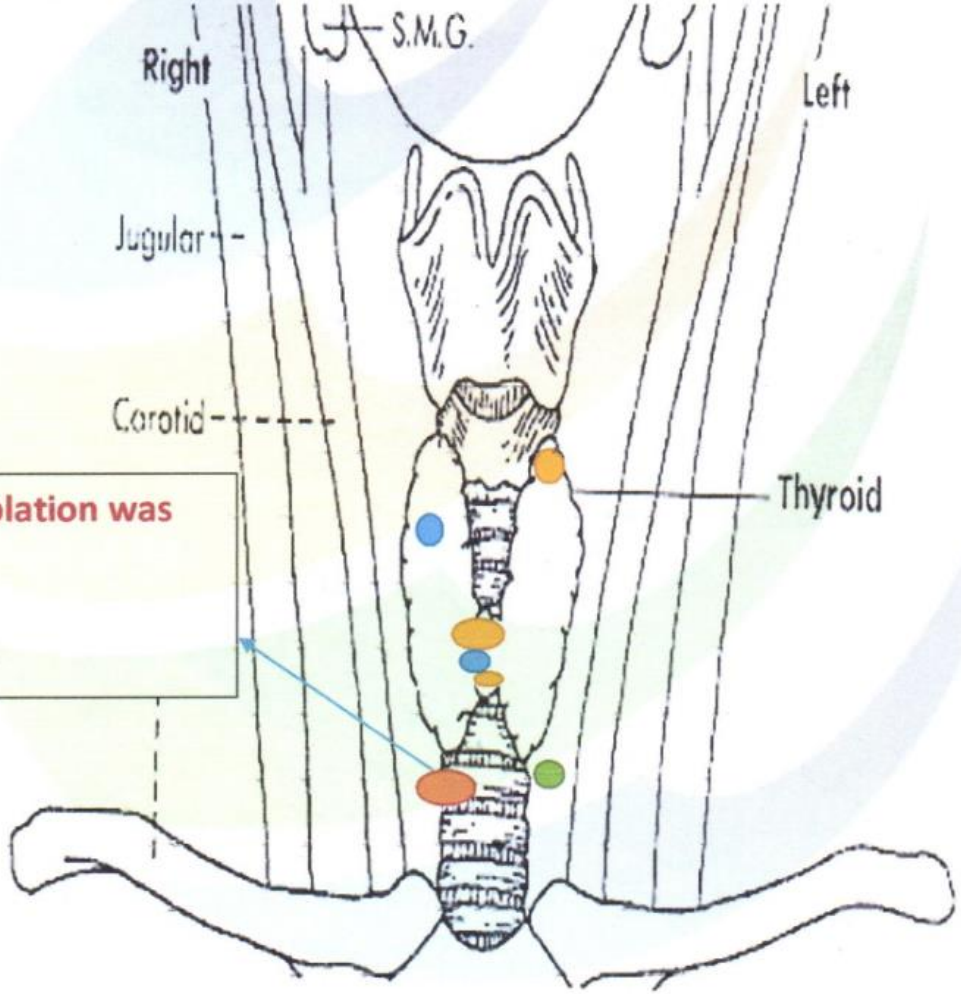
Parathyroid adenoma

enlarged parathyroid gland with mild central heterogenicity

Isoechoic nodule with calcification

Cystic nodule

Normal parathyroid gland



-Microwave ablation was done

-12 x 9 x 6 mm

Best Regards

Dear Dr. Rezvanian

SONOGRAPHY OF THYROID AND NECK:

1. The thyroid lobes and isthmus have normal size, parenchymal echopattern and increased vascular flow.
   - RL= 34x17x13 mm RL volume= 4 cc
   - LL= 41x10.5x10 mm LL volume = 2 cc
   - AP diameter of isthmus = 2.5 mm
2. An isoechoic solid cystic (Mainly solid) nodule with regular border and wall calcification in diameter of 11.5x7x11.5 mm is seen in right side of isthmus.
   - A similar nodule in diameter of 7.5x4.5x5.5 mm is seen in upper part of left lobe.
   - A similar nodule in diameter of 2 mm is seen in right side of isthmus.

   (ATA: Intermediate suspicion ACR-TIRADS: Moderately suspicious, IV)

   Follow up sonography is recommended.
3. A cystic nodule in diameter of 3.5 mm is seen in right side of isthmus. (Benign pattern)
   - A similar nodule in diameter of 3 mm is seen in upper part of right lobe.
4. Right lower parathyroid gland is mildly large (in diameter of 9x6x12 mm) and has increased vascular flow & central mild heterogenicity.

   Microwave ablation was done.
5. Left parathyroid gland is seen with normal size (5.7x3.4 mm).
6. LAP is not detected.
7. Parotid and submandibular glands have normal appearance.

نام بیمار : شوکت یوسفیان **تاریخ : ۱۴۰۲/۵/۱۶**

یا من اسمه دواء و ذکره شفاء

همکارارجمند جناب اقای دکتر رضوانیان

با سلام

درسونوگرافی تیروئید :

تیروئید اندازه طبیعی و لوب راست ابعاد تقریبی ۱۵×۱۶×۳۶ میلیمتر و لوب چپ ابعاد تقریبی ۱۲×۱۲×۳۶ میلیمتر دارد .

ساختمان بیضوی ایزواکوی مختصر هتروژن حاوی کانون کلسیفیه به قطر ۴/۵ میلیمتر در قسمت مرکزی آن و با حدود نه چندان مشخص (Ill-defined) به ابعاد تقریبی ۷/۵×۱۴ میلیمتر در قسمت قدامی داخلی لوب راست (با گسترش به ایسموس) دیده شد . سونوگرافی F/U توصیه می شود ((Moderately suspicious) TIRADS : 4)

۵-۴ ناحیه بیضوی ایزواکوی هتروژن که بعضی از آنها حاوی جزء کیستیک بوده و ابعاد بزرگترین آنها ۳×۶ میلیمتر می باشد بصورت پراکنده در لوب راست و ساختمان بیضوی ایزواکو حاوی جزء کیستیک با حدود مشخص و منظم به ابعاد تقریبی ۳/۵×۶ میلیمتر مطرح کننده کلوئیدندول در قسمت فوقانی لوب چپ دیده شد .

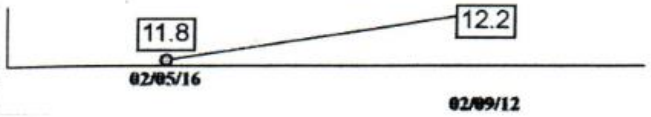
اکوی تیروئید در سایر نواحی طبیعی و یکنواخت می باشد .

Biochemistry Continue

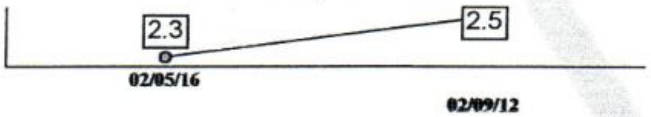
Calcium	12.2*	mg/dL	Enzymatic	Infants : < 1 year 8.7 - 11 Children : 1 - 17 year : 9.3 - 10.6 Adult : > 18 year : 8.5 - 10.5
Phosphorus	2.5*	mg/dL	photometric	2.7-5.0
Magnesium	2.08	mg/dL		1.9 - 2.5
Albumin	4.8	g/dL	Photometric	3.5 - 5.2

* = Confirmed by Repeated Analysis

Calcium



Phosphorus



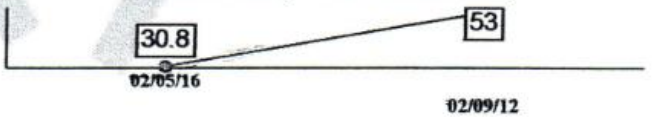
Albumin

Hormone Analysis

Test	*Result*	*Unit*	*Risk*	*Method*	*Reference Interval*
P.T.H	163	pg/ml		ECLIA	15-65
Vitamin D3 (25OH-Vitamine D)	53	ng/mL		CLIA	Deficient : < 10 Insufficient : 10-30 Sufficient : 30-100 Toxic level : >100

P.T.H

Vitamin D3 (25OH-Vitamine D)



Regards: Dr. M. Afzal Prof. S. H. Zarkesh Dr. A. Sobhan Dr. A. Taraghian

Name: Mrs. Shokat Yousefian
Date: 1402.05.25
Age: 70 Y/O
ID: 5129767357

Parathyroid Scan

Procedure:

The scan was performed after I.V. injection of 20 mCi of Tc99m-Sestamibi. Static and SPECT images were obtained at early and delayed (15min, 90 and 180 hours) phases of the neck and mediastinum.

Description:

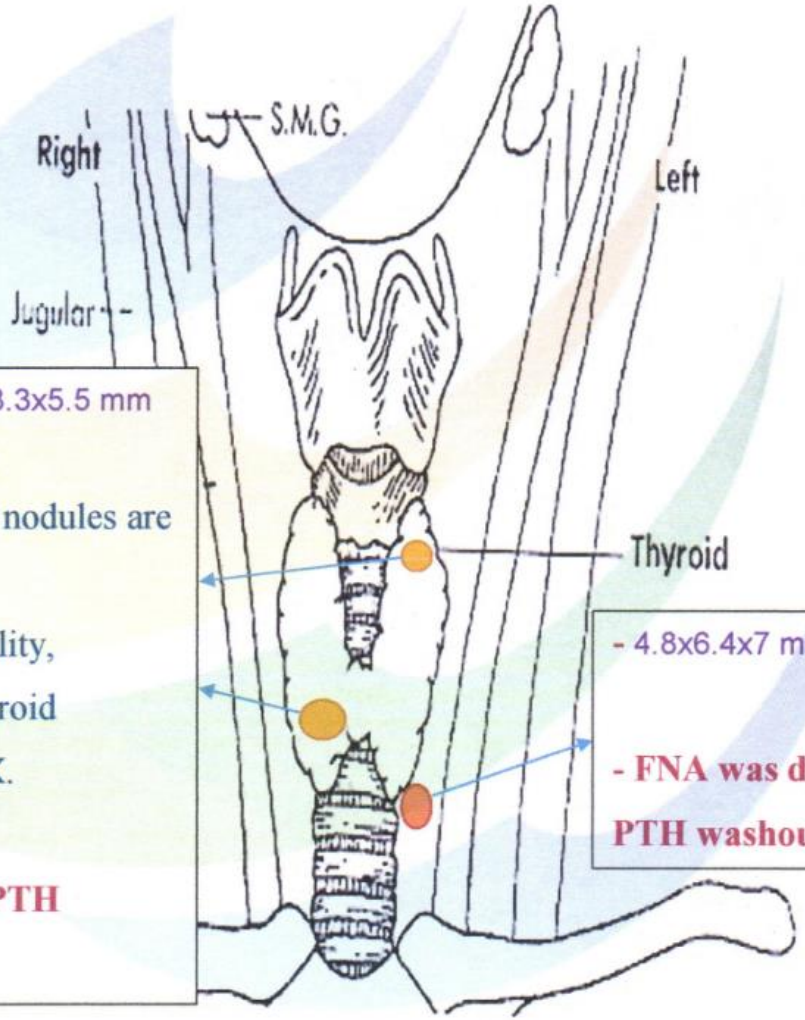
The scan revealed normal washout of radiotracer from thyroid and parathyroid glands in delayed planar and the SPECT images.

Impression:

- **Normal parathyroid scan.**

Hypoechoic mass, highly suggestive for parathyroid adenoma

Hypoechoic thyroid nodule



- 7x3.5x7 mm & 3.2x3.3x5.5 mm

-Although mentioned nodules are intrathyroidal,

-but with low probability, intrathyroidal parathyroid adenomas are in DDX.

-FNA was done for PTH washout.

- 4.8x6.4x7 mm

- FNA was done for PTH washout.

Best Regards

Dr. Mohammad Nilchian

ParathyroidScintigraphy with99mTc-sestamibi

Patient Name: Mrs. Khosravi, Shahin

Date:1401/12/08

Age: 53 Y/O

Gender: F

Referring Physician: Dr.Behradmanesh

Imaging Procedure:

After IV injection of 20 mci 99mTc-sestamibi, sequential imaging was performed from neck and upper mediastinum in anterior projection. The delayed images were obtained after 2 and 4 hours. Thyroid imaging was also performed in another day.

Imaging Findings:

Early images show homogenous activity in the thyroid gland. Delayed images reveal no abnormal activity in the same region and normal radiotracer wash out is seen from the thyroid gland.

Impression:

The scan is negative for sestamibi-avidparathyroid adenoma.

نام و نام خانوادگی : شهین خسروی تاریخ : ۱۴۰۱/۱۲/۰۳ پزشک معالج : دکتر بهرادمنش

با سلام و احترام

THYROID AND NECK SONOGRAPHY:

لوب های تیروئید در دو طرف دارای ابعاد نرمال و حدود منظم می باشند.

لوب راست : ۳۵ * ۱۶ * ۱۷ میلی متر و حجم تقریبی ۵ سی سی

لوب چپ : ۳۱ * ۱۲ * ۱۵ میلی متر و حجم تقریبی ۳ سی سی

ضخامت ایسم برابر با ۳ م م است.

اکوپترن لوب ها نان هموژن می باشد.

<u>لوب چپ :</u>

۱) یک ندول ایزواکو تا هایپو اکو و mixed echo ، فاقد میکروکلسیفیکاسیون به ابعاد ۶ * ۵ م م در پارانشیم خلفی (TIRADS III)

۲) یک ندول هایپو اکو و mixed echo ، فاقد میکروکلسیفیکاسیون به ابعاد ۶ * ۵ م م به صورت اگزوفیتیک در پل تحتانی (TIRADS III)

<u>لوب راست :</u>

۱) دو ندول هایپو اکو و mixed echo ، فاقد میکروکلسیفیکاسیون به ابعاد ۹ * ۵ م م و ۱۲ * ۷ م م در پارانشیم خلفی (TIRADS III)

۲) یک ندول هایپو اکو و mixed echo ، فاقد میکروکلسیفیکاسیون به قطر ۴ م م (TIRADS III)

میکروکلسیفیکاسیون بدخیم در لوب های تیروئید مشاهده نمی شود.

اثری از ضایعات تومورال در لوب ها دیده نمی شود.

عروق گردنی طبیعی هستند. غدد بزاقی و سایر نسوج گردن نرمال به نظر می رسند.

تصویر چند لنف نود سرویکال با نمای اوال و هیلوم اکوژن و حداکثر ابعاد ۱۵ * ۶ م م در سمت راست و ۱۲ * ۴ م م در سمت چپ دیده می شود که عمدتاً نمای راکتیو دارند.

ه پذیرش : ۱۲۸۴-۱۲ کد ملی :۴۶۷۹۲۲۱۵۴۲ تاریخ پذیرش : ۱۴۰۲/۱۲/۰۷ پزشک معالج : جناب آقای دکتر محمد نیل چیان ۱

عه کننده : خانم شهین خسروی سن : ۵۴ سال تاریخ نمونه گیری : تاریخ پذیرش

Hormone

Test	Result	Unit	Method	Normal Range
Parathyroid Hormone(FNWashout)	71.6 (Left Lobe)	pg/ml	ECL	< 100: suggestive the biopsy site do contain PTH-secreting tissue >=100: suggestive of the presence PTH-secreting tissue
Parathyroid Hormone(FNWashout)	69.3 (Right Lobe)	pg/ml	ECL	< 100: suggestive the biopsy site do contain PTH-secreting tissue >=100: suggestive of the presence PTH-secreting tissue
Parathyroid Hormone(FNWashout)	56830 (Left Cervical mass)	pg/ml	ECL	< 100: suggestive the biopsy site do contain PTH-secreting tissue >=100: suggestive of the presence PTH-secreting tissue

Dr.P. Nematollahi
Fellowship of hematopathology

Dr.F.S. Forootan
MD,PhD. Medical Genetics

Dr.A. Abedi
Fellowship of hematopatholo

Dr.V. Ostadi
PhD. of Medical Immunology

Name: Ali Asghar Mazaheri

1402.11.29

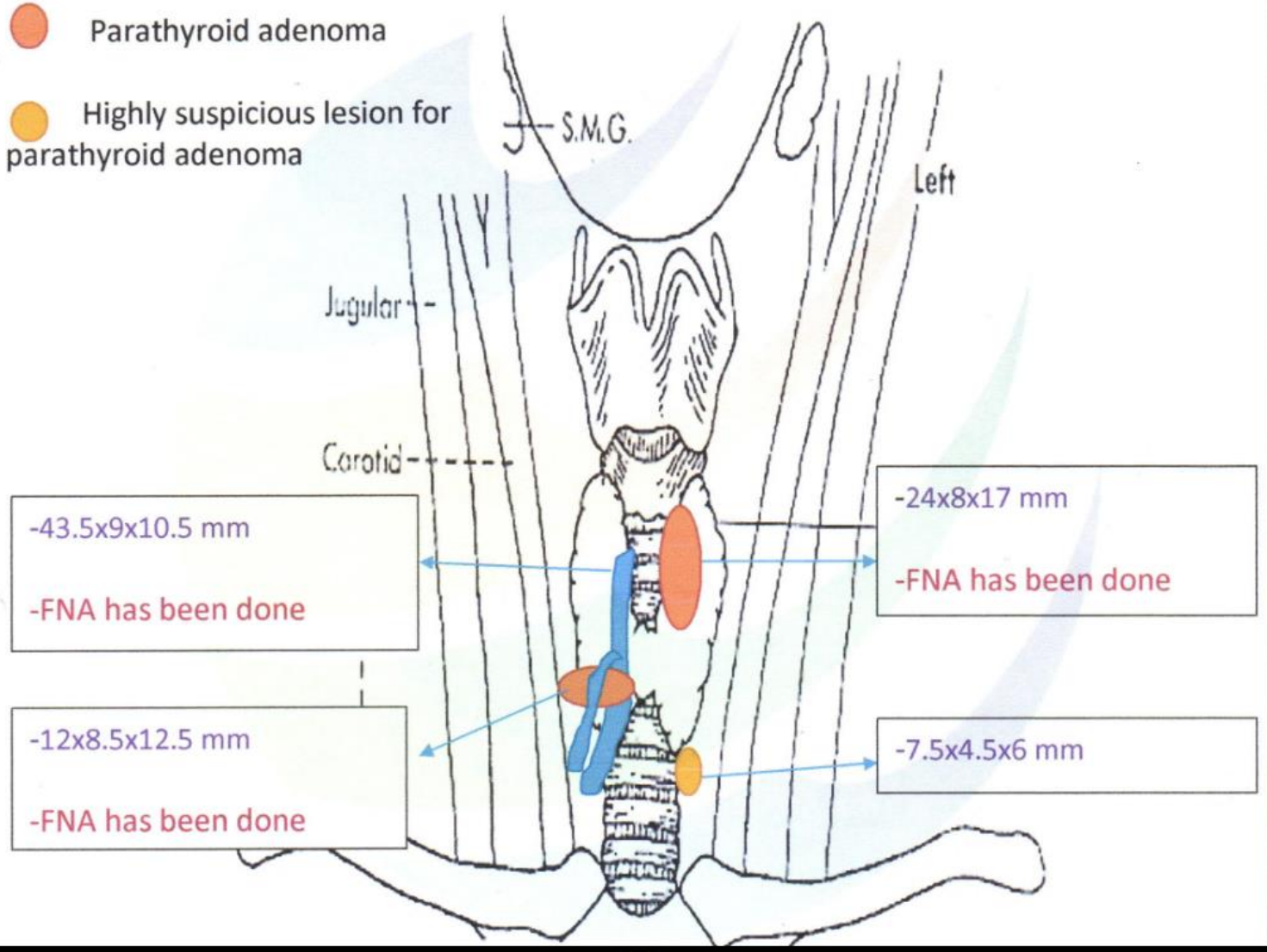
Dear Dr. Rezvanian

No: 5277

Parathyroid adenoma

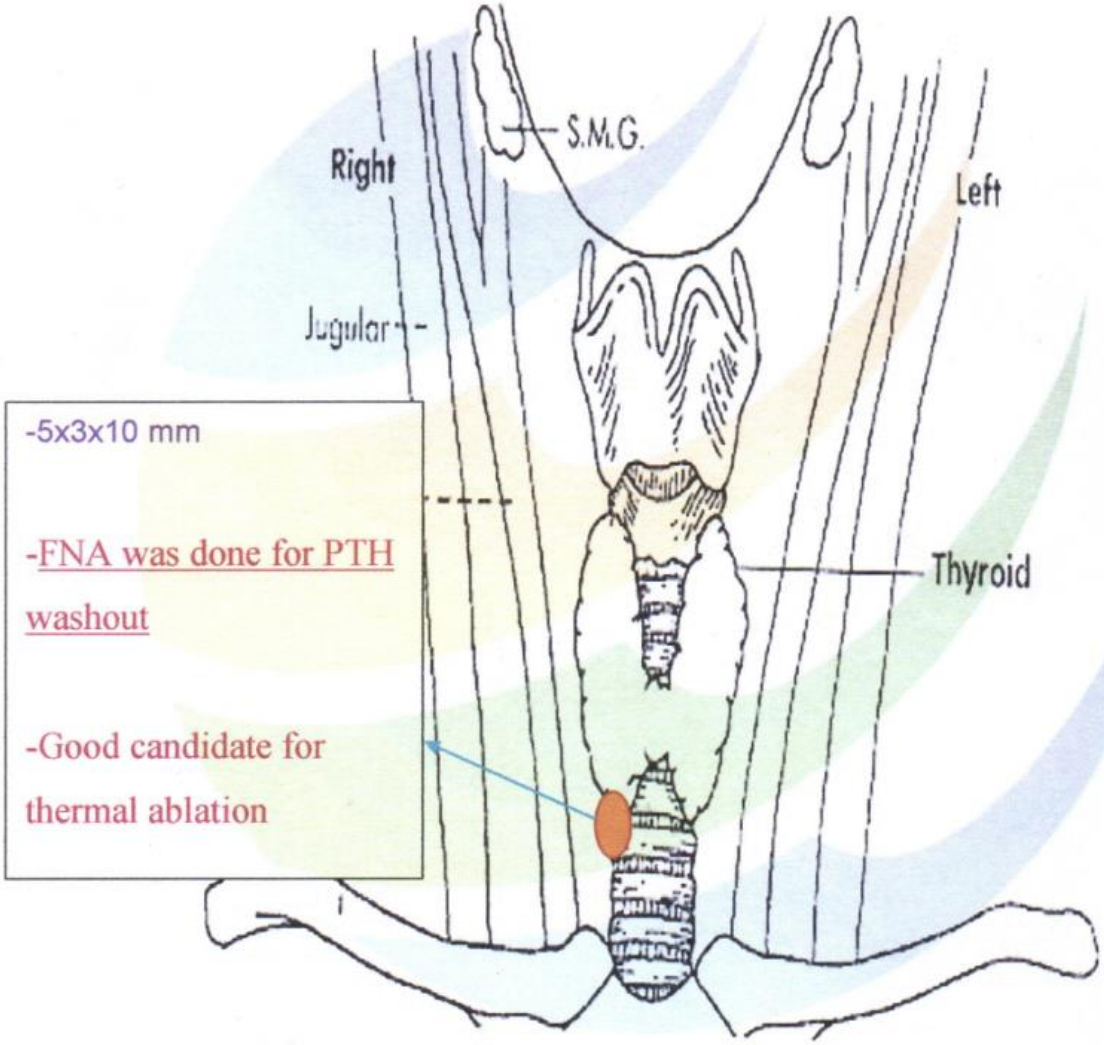
Parathyroid adenoma

Highly suspicious lesion for parathyroid adenoma



Dear Dr. Kachouie **No: 5770**

Highly suspicious lesion for parathyroid adenoma



Best Regards

Patient Name: Mrs. Fatemeh Jannesraie

Date: 1402/12/07

Age: 56 y/o

ID: 1141622521

Parathyroid Scan

Procedure:

The scan was performed after I.V. injection of 20 mCi of Tc99m-Sestamibi. Static and SPECT images were obtained at early and delayed (15min, 90 and 180 minutes) phases of the neck and mediastinum.

Description:

The scan discloses homogeneous radiotracer uptake within the thyroid bed thoroughly which is consequently washed out in delayed images.

Impression:

- **Normal parathyroid scan**

شمـــاره پذیرش : ۱۲ـ۱۸۷۳ کد ملی :۱۱۴۱۶۲۲۵۲۱ تاریخ پذیرش : ۱۴۰۲/۱۲/۲۱ پزشک معالج : جناب آقای دکتر محمد نیل چیان 1
نام مراجعه کننده : خانم فاطمه جان نثاری سن : ۵۵ سال تاریخ نمونه گیری : تاریخ پذیرش ص: ۱

Hormone

est	Result	Unit	Method	Normal Range
arathyroid Hormone(FNWashout) . .H	21738	pg/ml	ECL	< 100: suggestive the biopsy site does not contain PTH-secreting tissue >=100: suggestive of the presence PTH-secreting tissue

=High

Dr.P. Nematollahi
Fellowship of hematopathology

Dr.F.S. Forootan
MD,PhD. Medical Genetics

Dr.A. Abedi
Fellowship of hematopathology

Dr.V. Ostadi
PhD. of Medical Immunology

دکتر پردیس نعمت الهی
۸۷۵۴۰۰۲-۰۵ ۱۹۶۳ ن.ظ
دکتر فرزاد سید فروتن
۶۲۸۷۷-۲۰۵ ۴۴۶۰ ن.ظ
دکتر اکرم عابدی
۱۰۸۴۱۷-۲۰۵ ۴۰۹۰ ن.ظ
دکتر وجیهه استادی
۴۹۹۴ ن.ظ

آزمایشگاه مفید

Washout + ۴۲

PTH

False positive scan

Dear Dr: *Taghipoor*

Parathyroid Scintigraphy
(SPECT)

Procedure:

15,60, and 120 minutes after IV injection of 740 MBq Tc-99m sestamibi, the study was performed from anterior neck and mediastinum.

Description:

Imaging at 15 minutes shows normal uptake of thyroid gland with a focus of increased uptake adjacent to lower pole of right thyroid lobe. Delayed images show complete radiotracer washout from both lobe with a focus of radiotracer retention adjacent to lower pole of right lobe.

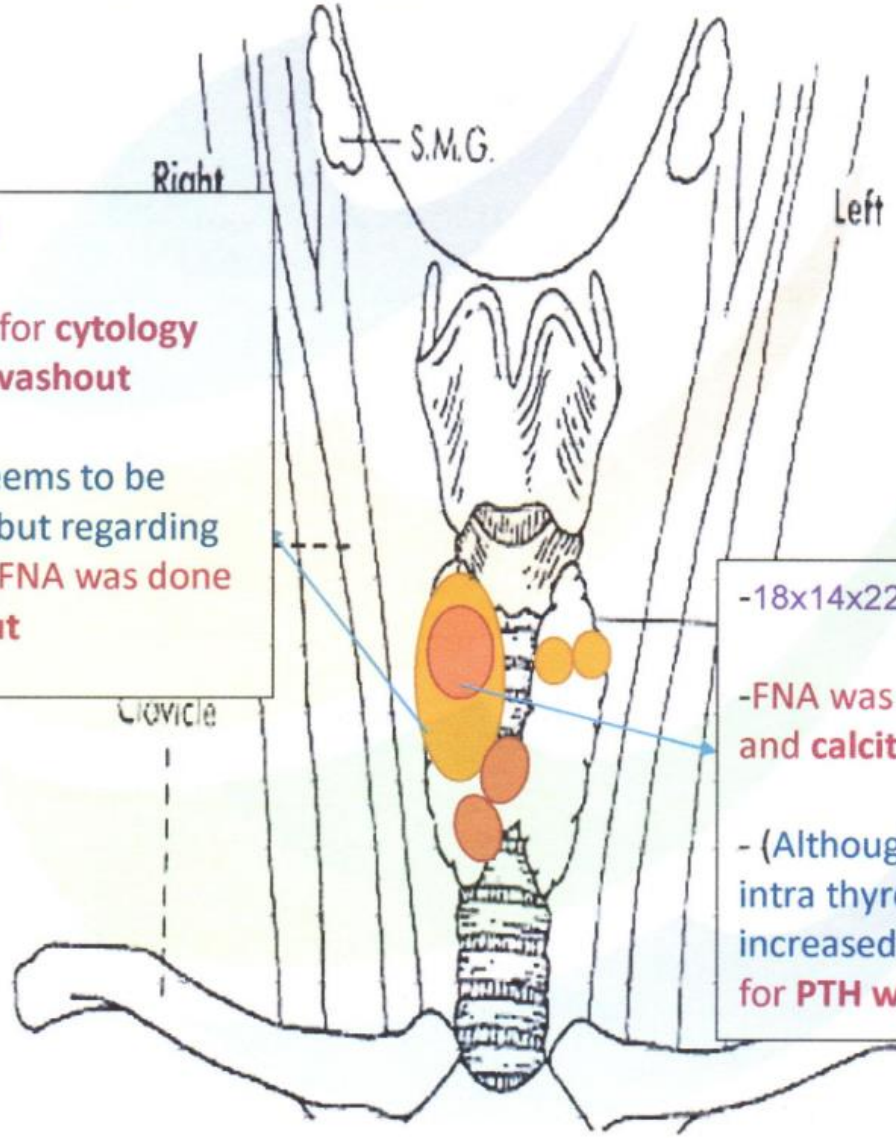
Interpretation:

The study is suspicious for parathyroid adenoma posterior to right thyroid lobe. However a large thyroid nodule can mimic this pattern. Further evaluation is recommended.

Yours Sincerely
Nuclear physician

Hypoechoic nodules with wall calcification

Hypoechoic solid nodules without calcification



-23x25.5x31 mm

-FNA was done for **cytology** and **calcitonin washout**

- (Although it seems to be intra thyroidal, but regarding increased PTH) FNA was done for **PTH washout**

-18x14x22 mm

-FNA was done for **cytology** and **calcitonin washout**

- (Although it seems to be intra thyroidal, but regarding increased PTH) FNA was done for **PTH washout**

Specimen:
A: Ultrasound guided FNA of right thyroid lobe, hypoechoic nodule
B: Ultrasound guided FNA of left thyroid lobe, calcified nodule

Macroscopic:
A: Received were 6 ml fluid and 6 smears. On the smears Pap and Giemsa staining were performed. From fluid cell block was prepared and PTH and calcitonin concentration were measured.
B: Received were 6 ml fluid and 7 smears. On the smears Pap and Giemsa staining were performed. From fluid cell block was prepared and PTH and calcitonin concentration were measured.

Microscopic: A&B: Smears revealed epithelial cells forming papilla, monolayer sheets and clusters. These cells have large, oval nuclei with dispersed chromatin pattern and intranuclear cytoplasmic inclusion. PTH and calcitonin in the needle washout after fine-needle aspiration were undetectable.

Diagnosis:
A: Ultrasound guided FNA of right thyroid lobe, hypoechoic nodule:
Papillary carcinoma

B: Ultrasound guided FNA of left thyroid lobe, calcified nodule:
Papillary carcinoma

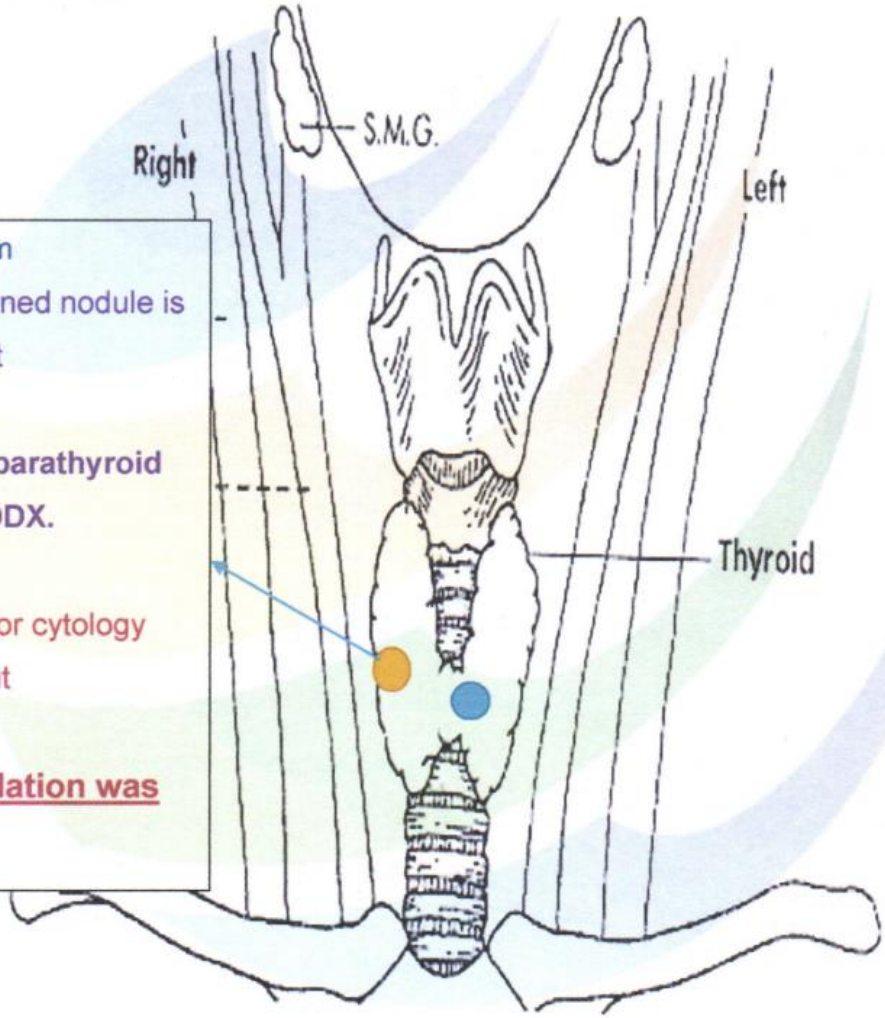
Pathologist: Dr.Mitra Heidarpour
دکتر میترا حیدرپور
متخصص کلینیکال آناتومیکال پاتولوژی
دانشیار دانشکده پزشکی
ن : پ : ۷۳۸۱۴ ن . آ : ۲۰۹۹

Name: Forough Ghadiri
Dear Dr. Behradmanesh

1402.12.01
No: 5308

Hypoechoic solid nodule

Isoechoic solid nodule



-10.5x5.5x7.7 mm

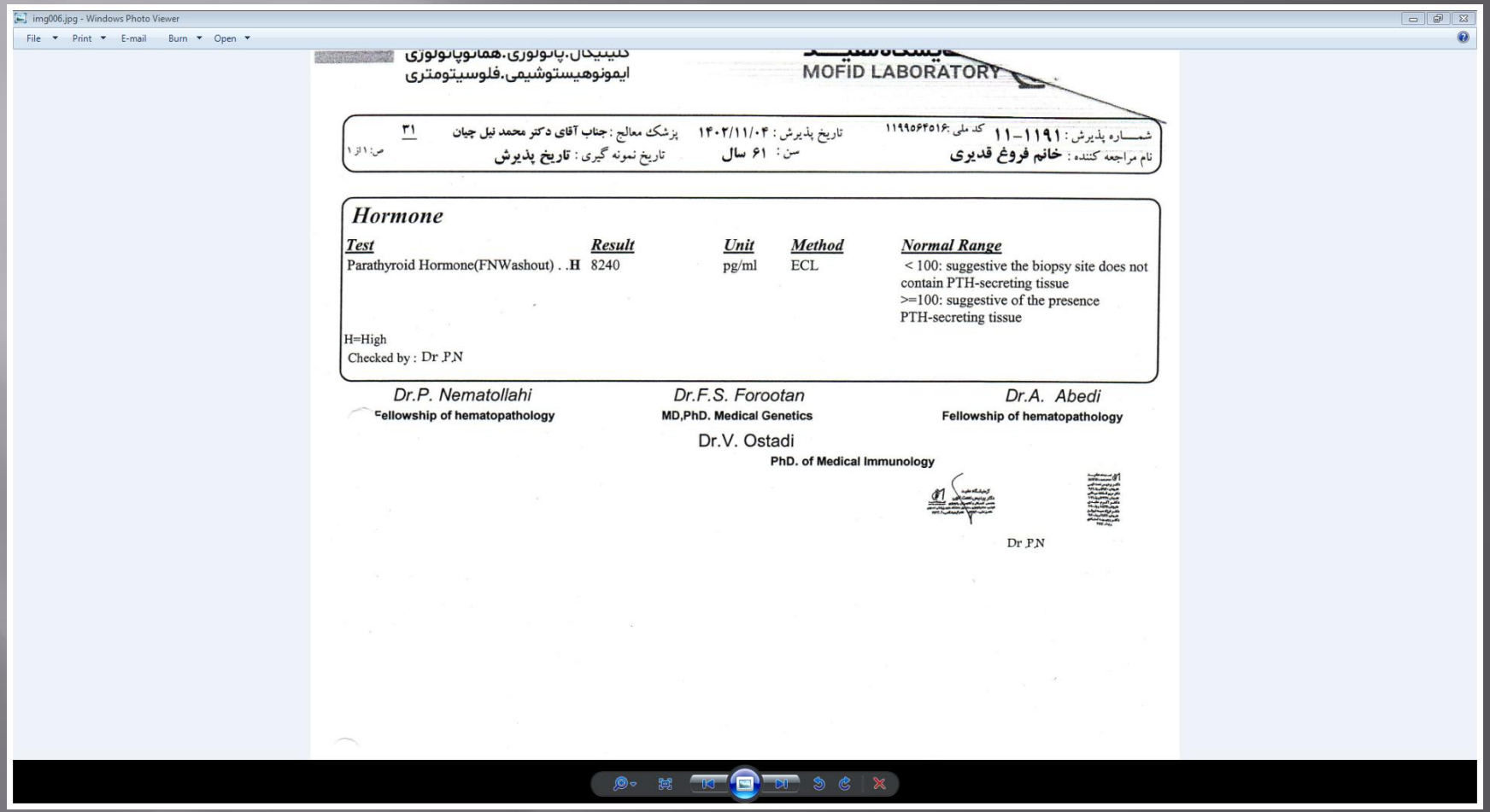
-Although mentioned nodule is intrathyroidal, but

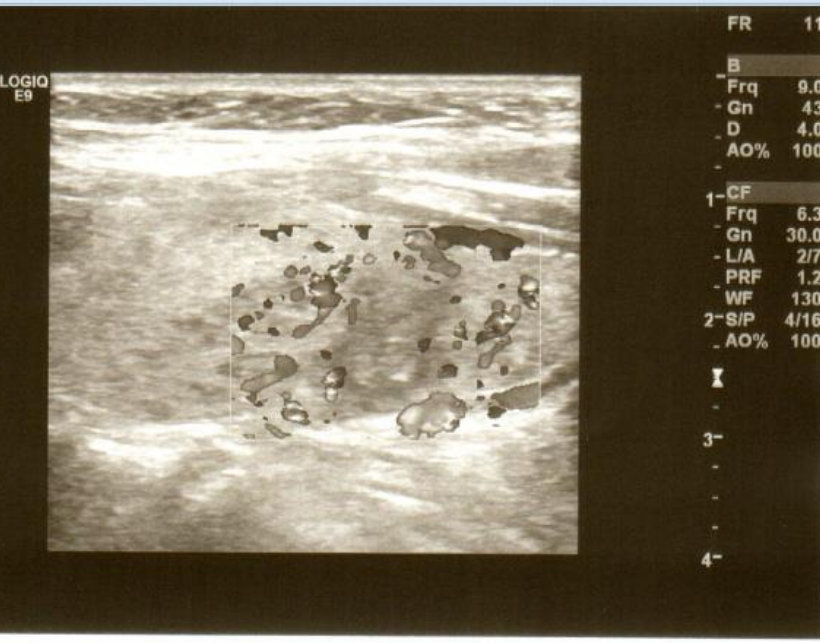
- **Intrathyroidal parathyroid adenoma is in DDX.**

-FNA was done for cytology and **PTH** washout

-**Microwave ablation was done.**

Intrathyroidal adenoma chronic thyroiditis





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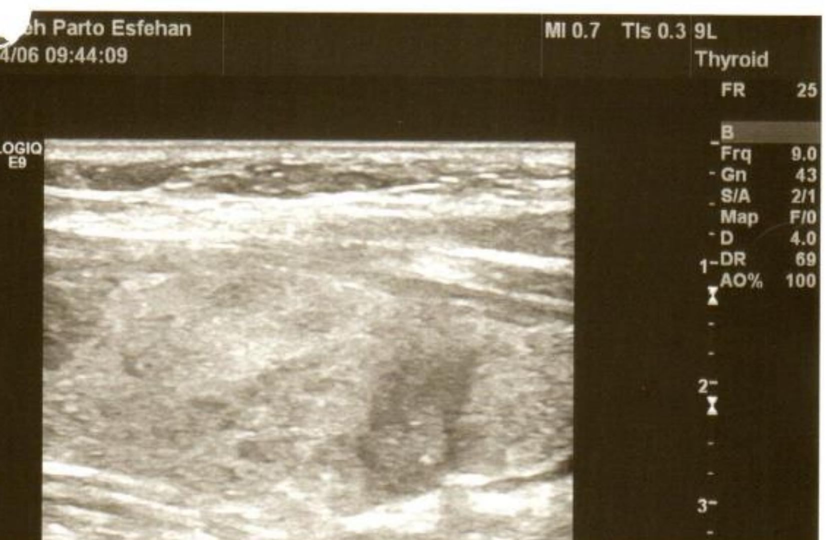
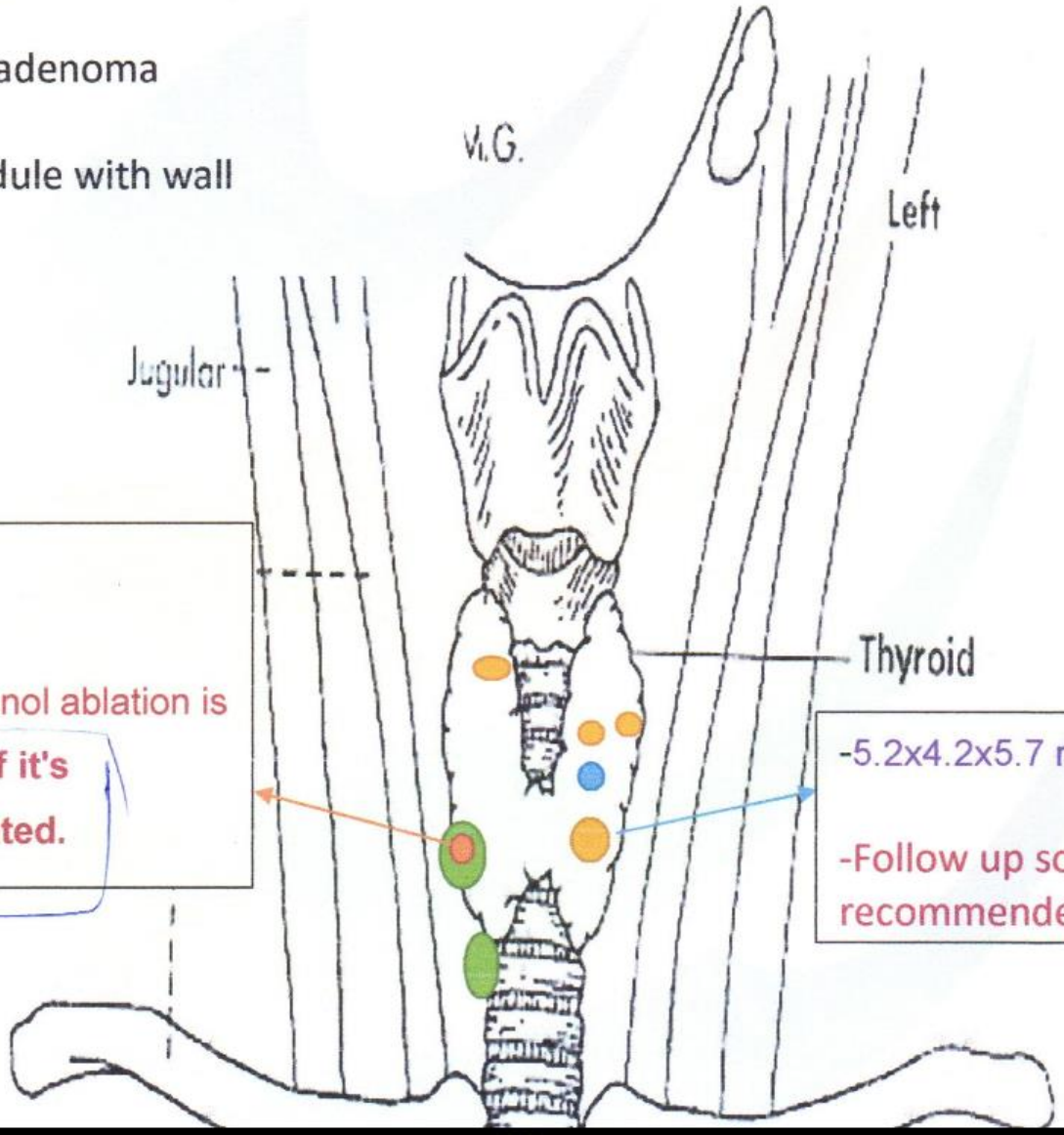


Hypoechoic nodule with NO calcification

Mildly enlarged parathyroid glands

Parathyroid adenoma

Isoechoic nodule with wall
alcification



-2 x 1.2 x 3 mm

-Thermal or ethanol ablation is recommended, **if it's clinically indicated.**

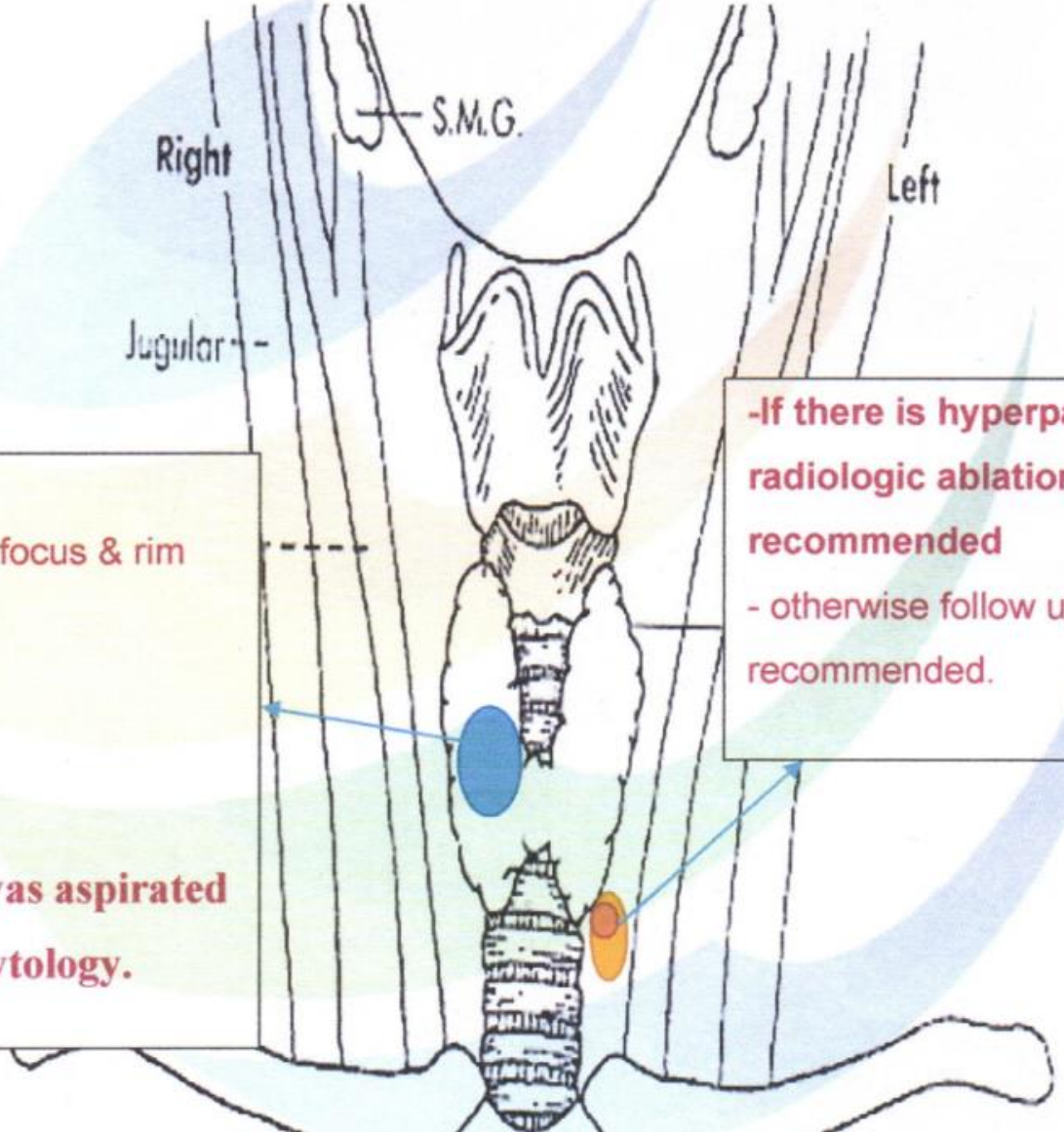
-5.2x4.2x5.7 mm

-Follow up sonography is recommended

Cystic nodule with hypoechoic component (secondary to thick secretion)

Enlarged parathyroid gland

Hypoechoic lesion



9x11.5x19 mm

one echogenic focus & rim

alcification

benign pattern

Cystic fluid was aspirated

nd sent for cytology.

-If there is hyperparathyroidism, radiologic ablation is recommended

- otherwise follow up sonography is recommended.

Dear Dr. Khalili

FNA AND SONOGRAPHY OF THYROID AND NECK:

1. The left thyroid lobe and isthmus are atrophic.
   The right thyroid lobe has normal size (Secondary to mentioned nodule).
   Thyroid lobes and isthmus have decreased parenchymal echopattern & normal vascular flow.
   - RL= 31x15x13 mm RL volume= 3 cc
   - LL= 23x8x7 mm LL volume = 0.6 cc
   - AP diameter of isthmus = 1 mm
2. A subcapsular cystic nodule with regular border, hypoechoic component (secondary to thick secretion), one echogenic focus, rim calcification & NO vascular flow in diameter of 9x11.5x19 mm is seen in right lobe. (benign pattern)
   Cystic fluid was aspirated and sent for cytology.
3. Left lower parathyroid gland has increased size in diameter of 11.5x3.5x6 mm with hypoechoic lesion in diameter of 2.2x2.5x5 mm.
   If there is hyperparathyroidism, radiologic ablation is recommended, otherwise follow up sonography is recommended.
4. LAP is not detected.

Best Regards

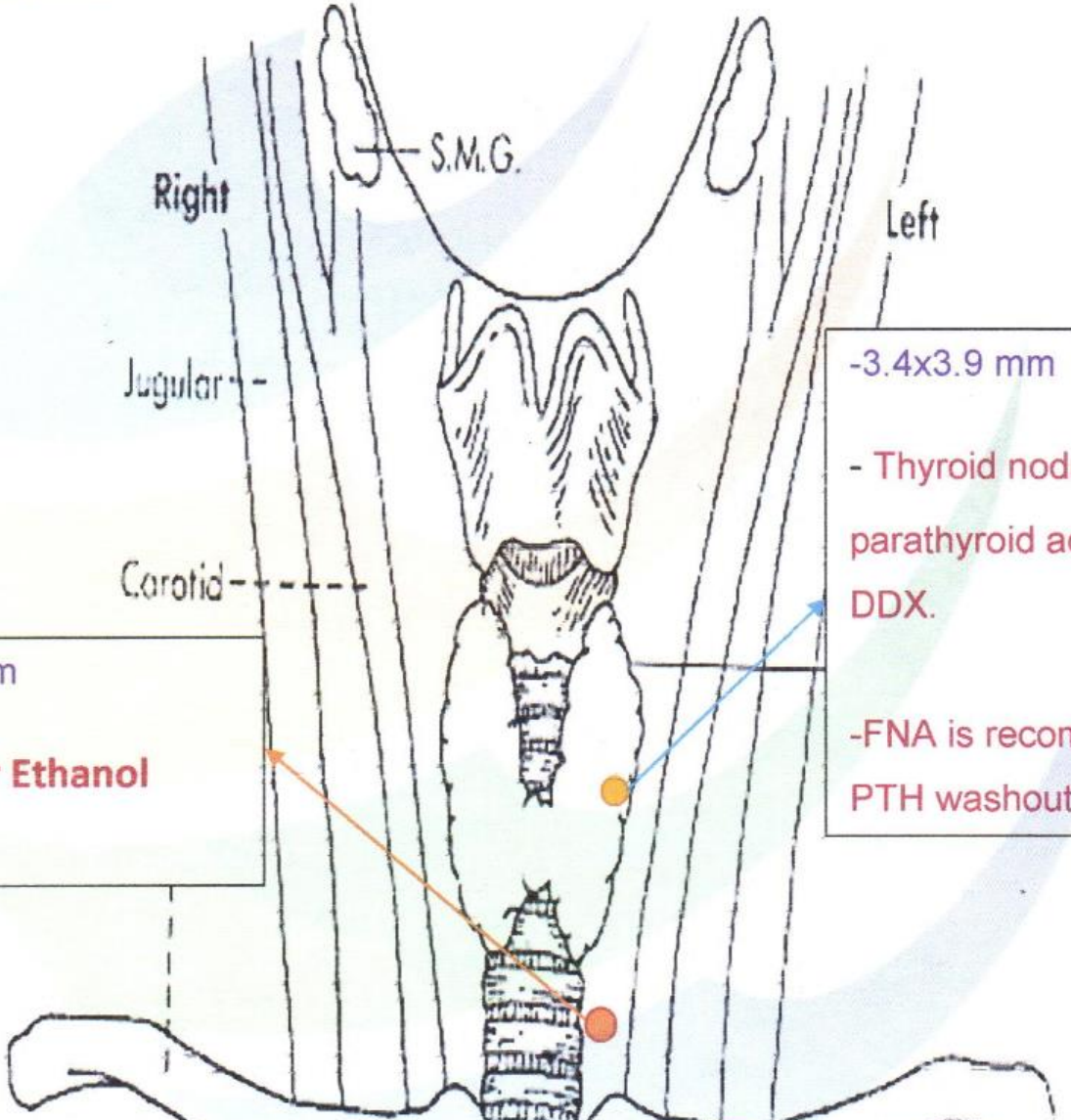
Dr. Mohammad Nilchian

Dear Dr. Samaie

No. 4781

Intra parathyroidal mass, highly suggestive for parathyroid adenoma

Hypoechoic nodule



-3.4x3.9 mm

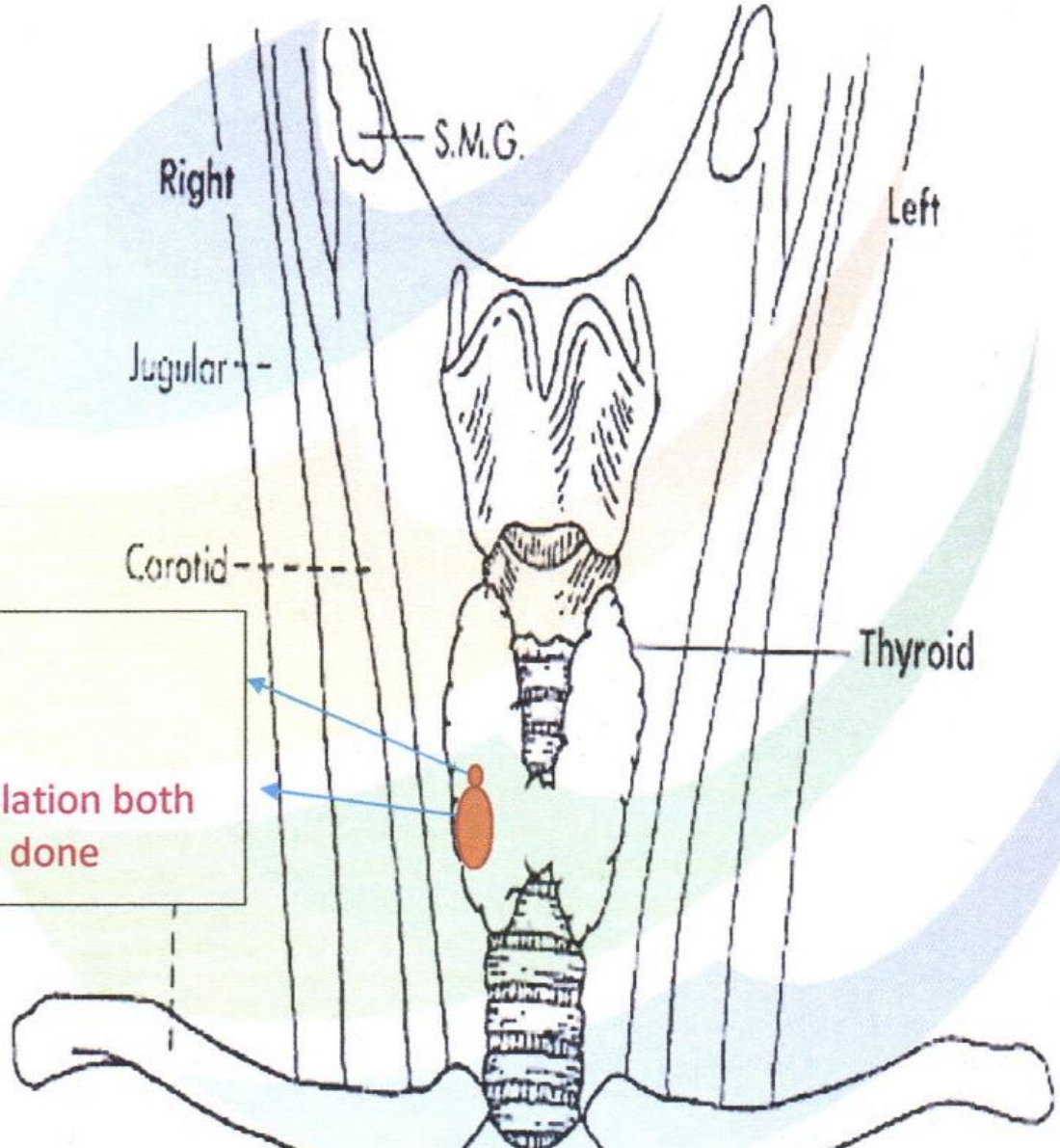
- Thyroid nodule & parathyroid adenoma are in DDX.

-FNA is recommended for PTH washout

-3.7x2.9x2.8 mm

-Candidate for Ethanol ablation

Parathyroid adenoma



-8.2x5.5x6 mm
-2 x 1.5 mm

-Microwave ablation both adenomas was done

ONOGRAPHY OF NECK FOR EVALUATION OF PARATHYROID GLANDS:

1. A hypoechoic solid mass in diameter of 8.2x5.5x6 mm is seen, posterior-inferior to lower pole of right lobe of thyroid.
   - **Sonographic appearance and vascular flow are compatible with parathyroid adenoma**.
   - **During ablation it was cleared that other hypoechoic mass** in diameter of 2x1.5 mm is seen adjacent to mentioned mass.
2. **Microwave ablation of both mentioned masses was done**.
3. There is NO suspicious thyroid nodule.

Best Regards

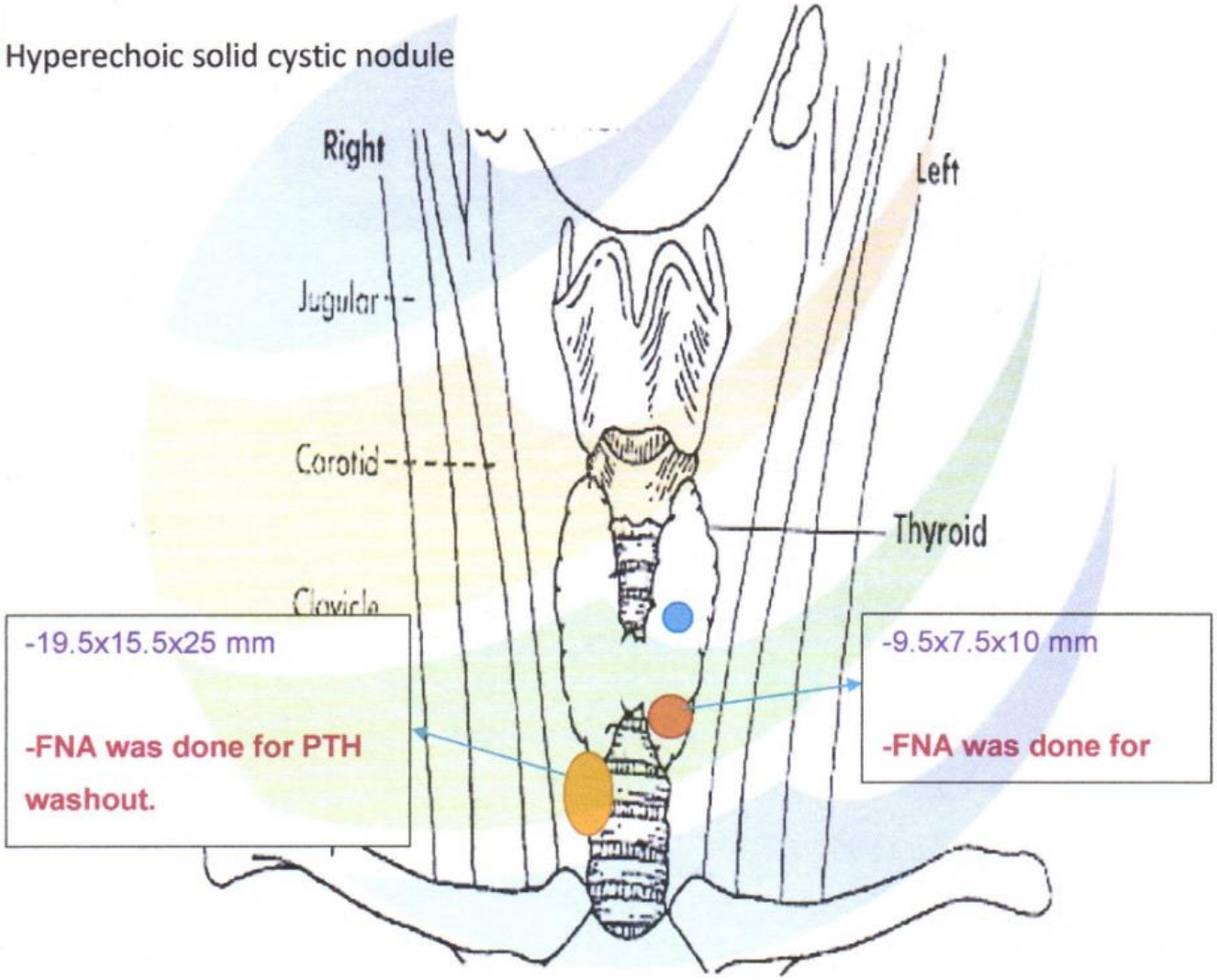
Dr. Mohammad Nilchian

Dear Dr. Mir Pourian **No: 5458**

Hypoechoic nodule

Highly suspicious lesion for parathyroid adenoma

Hyperechoic solid cystic nodule



NOGRAPHY OF NECK:

1. Right jugular vein has decreased size and NO vascular flow in favor of chronic thrombosis.
2. Left jugular vein has normal appearance and NO thrombosis is noted.
3. A hypoechoic solid nodule with regular border & NO calcification in diameter of 9.5x7.5x10 mm is seen in lower part of left lobe.

   (ATA: intermediate suspicion ACR-TIRADS: moderately suspicious, IV)

   FNA was done.
4. A hyperechoic solid cystic nodule with regular border in diameter of 6.5x4 mm is seen in middle part of left lobe.

   (ATA: Low suspicion ACR-TIRADS: NO suspicious, II)
5. A hypoechoic solid mass with regular border in diameter of 19.5x15.5x25 mm is seen posterolateral to lower part of right lobe, **highly suggestive for parathyroid adenoma.**

   FNA was done for PTH washout.
6. LAP is not detected.
7. Parotid and submandibular glands have normal appearance.

Impression:

- Left thyroid lobe nodule, suspicious for PTC
- Left cervical mass, suspicious for parathyroid adenoma
- Right jugular vein chronic thrombosis

There is no evidence of biliary ectasia.

2. Gallbladder is not seen. (Cholecystectomy)
3. Body of pancreas is normal.
4. Spleen has increased size with normal parenchymal echopattern (Spleen span: 165 mm & spleen size: 165x88x128 mm)
5. Both kidneys are seen with increased size, **significant increased parenchymal echopattern** and numerous cysts, compatible with ADPKD.
   - Right kidney size= 151x64 mm Parenchymal thickness= 23 mm
   - Left kidney size= 155x61 mm Parenchymal thickness= 20 mm

   No sign of renal parenchymal disease is seen.

   Bilateral mild hydronephrosis is seen, more dominant in right side, most likely secondary to urinary bladder volume.

   No renal stone or is seen, bilaterally.

   There are bilateral numerous cortical cysts upto 57x52 mm in right kidney and 68x42 mm in left kidney.
6. Urinary bladder is seen with normal volume (160 cc) and mucosal thickness with no stone or mass lesion.
7. Prostate has normal size at 40x25x35 mm with 19 cc volume, without bulging into the urinary bladder.
8. No free fluid is seen in abdominopelvic cavity.

pression:

- Splenomegaly
- ADPKD associated with significant increased parenchymal echopattern

Specimen:
A: Ultrasound guided FNA of right cervical mass
B: Ultrasound guided FNA of left thyroid lobe

Macroscopic: A: Received were 2 ml fluid and 8 smears. On the smears Pap and Giemsa staining were performed. In fluid PTH concentration was measured.
B: Received were 4 ml fluid and 7 smears. On the smears Pap and Giemsa staining were performed. From fluid cell block was prepared.

Microscopic: A: Smears revealed neuroendocrine epithelial cells forming monolayer sheets and clusters. These cells have small and uniform nuclei. PTH concentration in the needle washout after fine-needle aspiration was more than 1000 ng/ml.
B: Smears revealed epithelial cells forming papilla, monolayer sheets and clusters. These cells have large, oval nuclei with dispersed chromatin pattern.

Diagnosis:
A: Ultrasound guided FNA of right cervical mass:
Parathyroid adenoma

B: Ultrasound guided FNA of left thyroid lobe :
Findings are suspicious for Papillary carcinoma

Pathologist: Dr.Mitra Heidarpour

دکتر میترا حیدرپور

حجم غده تیروئید طبیعی است.

ابعاد لوب راست 39*20*13mm و با حجم 6cc طبیعی می باشد.
ابعاد لوب چپ 38*19*14mm و با حجم 5.5cc طبیعی می باشد.
قطر AP ایسموس برابربا 4.1mm طبیعی است.
هردولوب تیروئید با اکوپترن هتروژن محتوی نواحی ندولار وخطی
هایپواکوی متعدد مطرح کننده ی تیروئیدیت هاشیموتو رویت شدند تطبیق با TFT توصیه میشود
درخلف zone تحتانی لوب چپ تیروئید تصویر ندول solid هایپراکو با حدود ill- defined
به ابعاد 15.3*7.5mm وفاقد کلسیفیکاسیون مشاهده میشود .(TIRADS 4)
نمونه برداری از ندول فوق توصیه میشود .
اینفریور به لوب چپ تیروئید تصویر یک توده ی هایپواکو فاقد مدیاستن واضح به ابعاد
7.5*4.5mm ودرپاراتراکئال راست اینفریور به لوب راست تیروئید نیز
یافته ی مشابه به ابعاد 8.2*4mm مشاهده میشود که هردومیتوانند
مطرح کننده ی لنفادنوپاتی یا پاراتیروئید برجسته (باتوجه به شرح حال هایپرکلسمی) باشد
لنف نودهای مشابه درپاراتراکئال هردوسمت باحداکثر دیامتر کوتاه 3-4mm
تا محدوده ی سوپرااسترنال مشهود است
همچنین درسمت چپ در level 4 قسمت میانی زنجیره ی کاروتید لنف نود فاقد مدیاستن بانمای مشکوک
به دیامتر کوتاه 5mm مشاهده میشود .
لنفادنوپاتی درسایر قسمتهای زنجیره ی قدامی – خلفی گردن دردوسمت رویت نشد.

غده بزاقی Sub max دوطرف دارای حجم واکوژنیسیته طبیعی و فاقد سنگ و ضایعه فضاگیر است.
در نسج نرم گردن ضایعه فضاگیر دیده نشد.

نام مراجعه کننده : خانم مریم بهرامی سن : ۳۹ سال شماره سیتولوژی: Cit-02-1990

Specimen: Sonoguided FNA of left thyroid lobe

Macroscopic: Received were 10 smears. On the smear Pap and Giemsa stain were erformed.

Microscopic: Cytologically in a background of lymphocytic thyroiditis, some clusters of ollicular cells with macrofollicular, microfollicular and honey comb sheet pattern are seen. ocally some clusters of atypical hurthle cells with enlarged nuclei are seen. Colloid is anty.

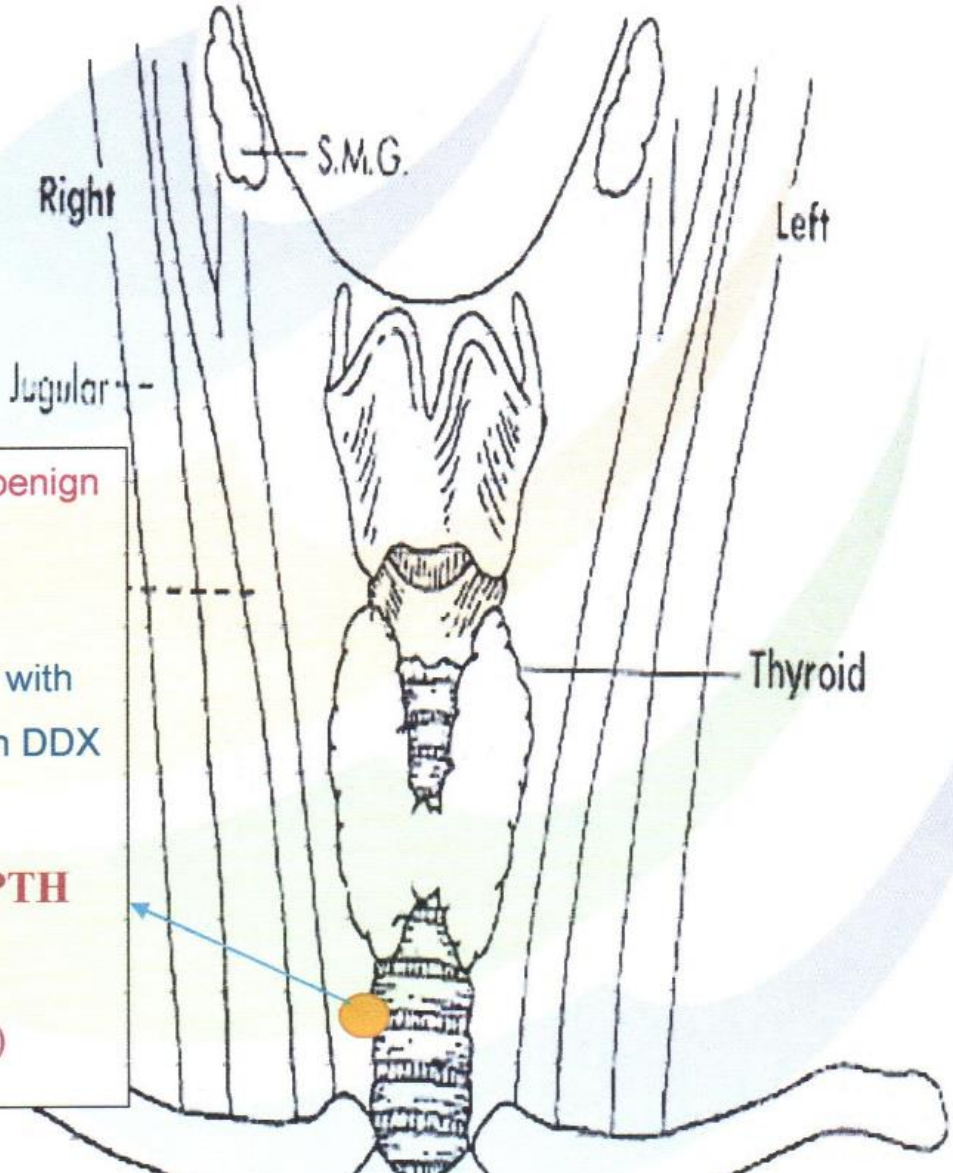
iagnosis: Atypia of Undetermined Significance (AUS)

omment: A background of lymphocytic thyroiditis with some clusters of urthle cells are seen. So, further sampling after an appropriate interval is commended.

Pathologist: Dr.Mitra Heidarpour

متخصص پاتولوژی آناتومیکال

Hypoechoic mass



-most likely in favor of benign reactive lymph node

- Parathyroid adenoma with very low probability is in DDX

-FNA was done for PTH washout (regarding increased serum PTH)

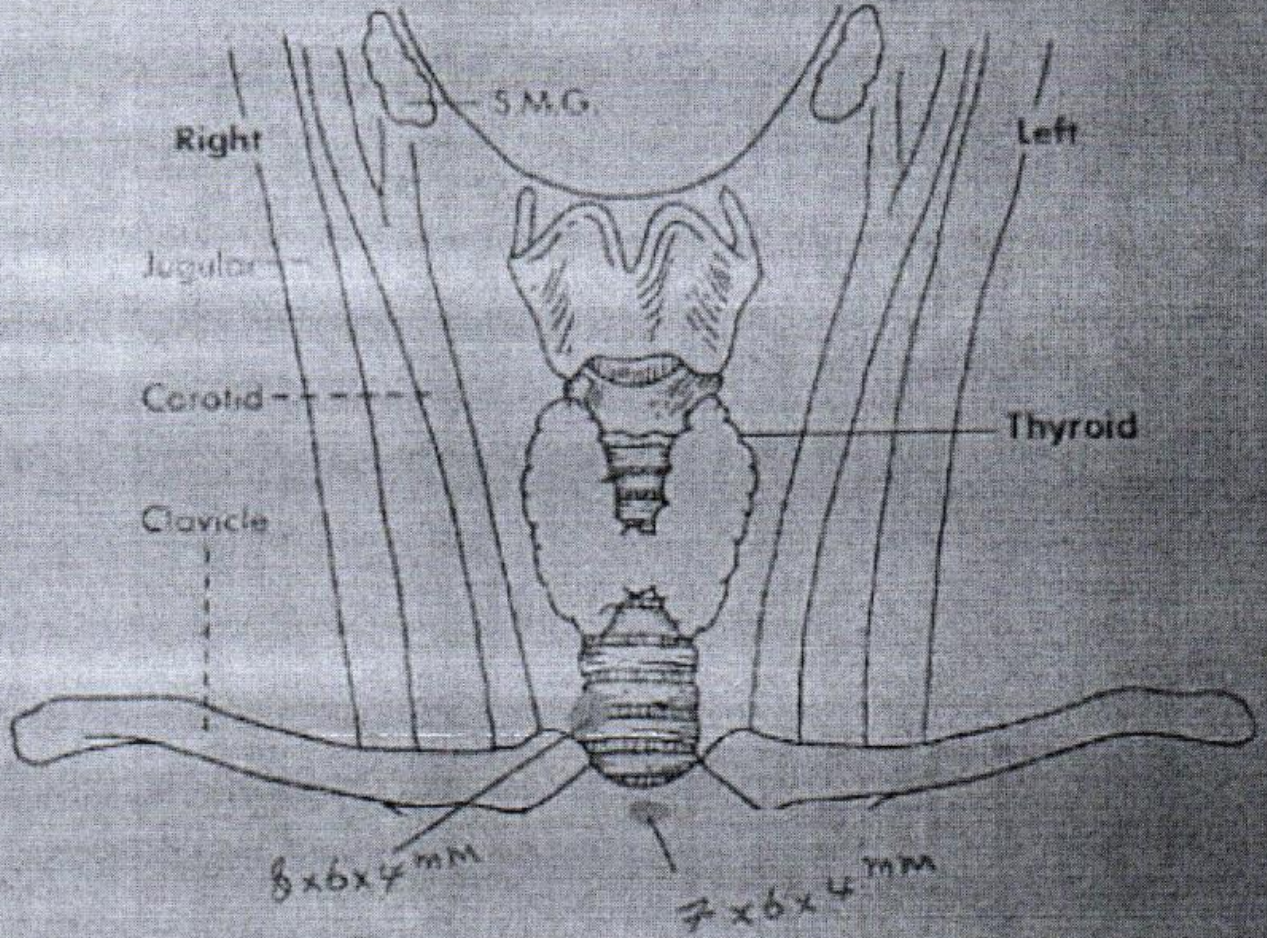
A AND SONOGRAPHY OF THYROID AND NECK:

1. The thyroid lobes have mild increased size, decreased & heterogeneous parenchymal echopattern, pseudonodules and increased vascular flow, compatible with chronic thyroiditis.
   - RL= 46x17x16 mm RL volume= 7 cc
   - LL= 50x19x12 mm LL volume = 6 cc
   - AP diameter of isthmus = 1 mm
2. There is no evidence of cystic or solid thyroid nodule. **(The nodule, which has been sampled for FNA, is pseudo nodule and isn't real nodule.)**
3. LAP is not detected.
4. A hypoechoic mass with regular border and internal vascular flow in diameter of 5x4.5x9 mm is seen in para midline, right side, inferior part of neck, **most likely in favor of benign reactive lymph node** and parathyroid adenoma with **very low probability** is in DDX.

   FNA was done for PTH washout. (Regarding increased serum PTH)
5. Parotid and submandibular glands have normal appearance.

Best Regards

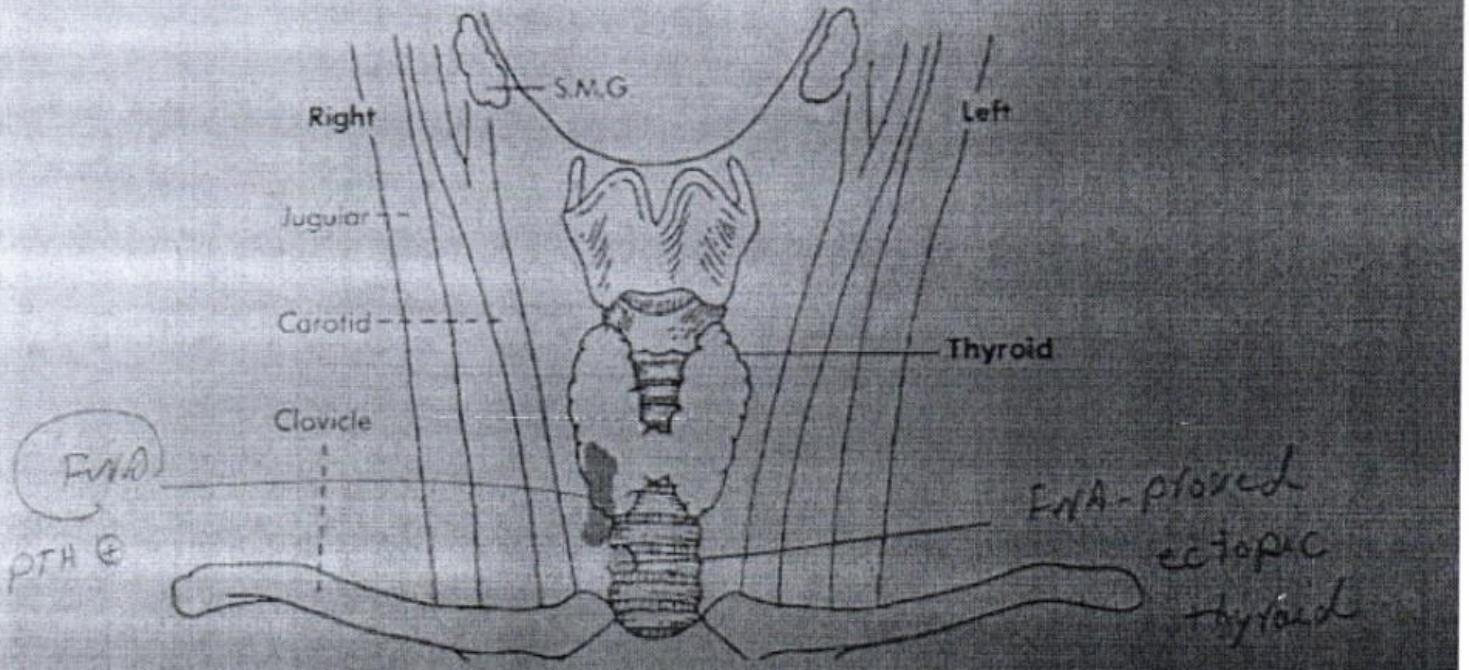
Dr. Mohammad Nilchian



دکتر بابک توکلی

sent for cytopathological evaluation.

- **Deeply, posteroinferior to the right thyroid lobe: 21 x 10 x 4 mm, 0.4 cc**



Please note that some lesions may not be included in the image, as it is just a map to show which lesions were sampled.

Regards

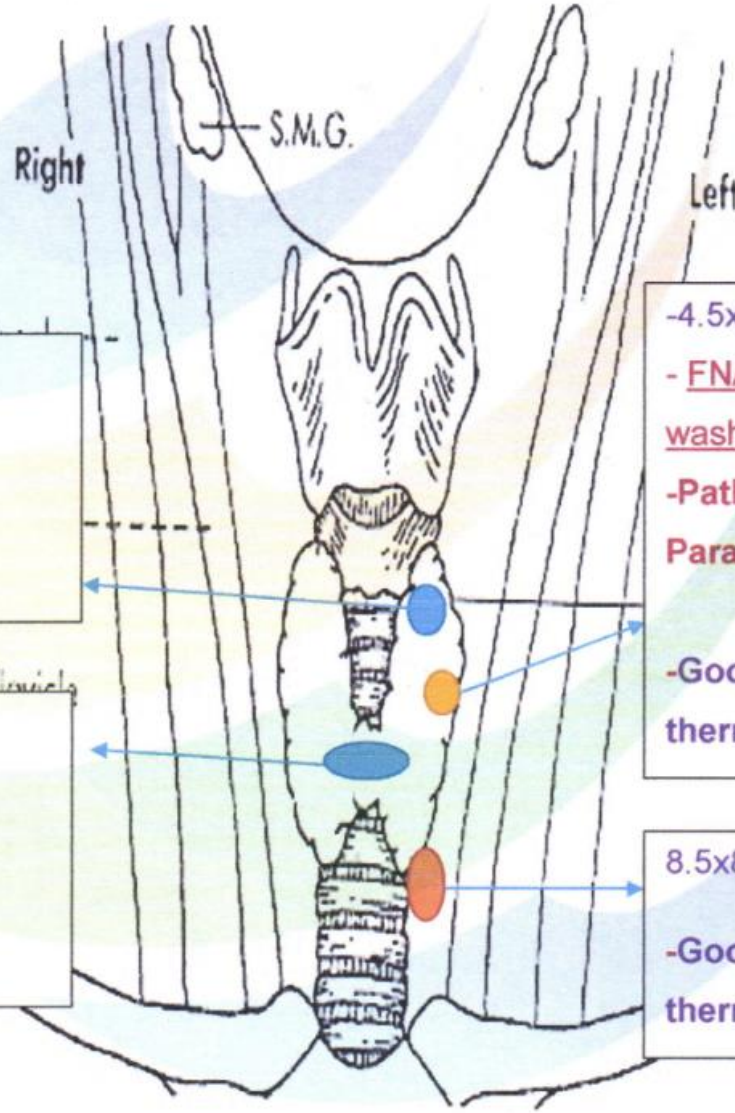
Name: Zahra Mohammadi 1403.01.27

Dear Dr. Behradmanesh No: 6031

Parathyroid adenoma

Highly suspicious lesion for parathyroid adenoma

Hypoechoic solid nodule



-10.5x6x8.5 mm

-FNA was done

-Pathologic report:

Benign nodule

-4.5x4x6.5 mm

- FNA was done for PTH washout.

-Pathologic report:

Parathyroid adenoma

-Good candidate for thermal ablation

-16.5x8x19 mm

-FNA was done

- Pathologic report:

Benign nodule

8.5x8.5x7 mm

-Good candidate for thermal ablation

Specimen:
A: Ultrasound guided FNA of thyroid isthmus nodule
B: Ultrasound guided FNA of left thyroid lobe
C: Ultrasound guided FNA of left cervical mass

Macroscopic:
A: Received were 4 ml fluid and 8 smears. On the smears Pap and Giemsa staining were performed. From fluid cell block was prepared.
B: Received were 6 ml fluid and 6 smears. On the smears Pap and Giemsa staining were performed. From fluid cell block was prepared and PTH concentration was measured.
C: Received was 2 ml fluid from in which PTH concentration was measured.

Microscopic: A&B: Cytologically in a background of degenerated RBCs, some clusters of follicular cells with macrofollicular and honey comb sheet pattern are seen. These cells have small uniform nuclei. Colloid is abundant and some hemosiderin laden macrophages are also noted. PTH was undetectable in the needle washout after fine-needle aspiration. There is **NO evidence of malignancy** in this specimen.
C: Smears revealed neuroendocrine epithelial cells forming monolayer sheets and clusters. These cells have small and uniform nuclei . PTH concentration in the needle washout after fine-needle aspiration was more than 1000 ng/ml.

Diagnosis:
A: Ultrasound guided FNA of thyroid isthmus nodule:
Benign follicular nodule (Nodular goiter)

B: Ultrasound guided FNA of left thyroid lobe:
Benign follicular nodule (Nodular goiter)

C: Ultrasound guided FNA of left cervical mass:
Parathyroid adenoma