Dr. D.Y. PATIL VIDYAPEETH, PUNE
(DEEMED UNIVERSITY)

A CASE OF FOLLICULAR THYROID CARCINOMA WITH TRACHEAL INVASION

DEPARTMENT OF GENERAL SURGERY
DR DY PATIL MEDICAL COLLEGE AND HOSPITAL, PUNE

- This 70 year old female presented with a painless swelling in front of her neck in midline which has gradually enlarged over the last 2 years.
- She also complained of shortness of breath on exertion since the past 15 days.
- There was no other significant past medical , surgical or family history.

- General examination :
- Blood Pressure : 130/80 mmHg
- Pulse Rate : 84bpm
- Respiratory Rate : 22/min
- Oxygen Saturation : 98% on room air

- On examination, a 15 cm x 10 cm swelling in the thyroid region extending bilaterally beyond the sternocleidomastoid ,superiorly 2 cms below the angle of the mandible with its lower border not visible , and the swelling moved with deglutition.
- It had a smooth surface ,was hard in consistency, and was not fixed to any underlying or overlying structures , and getting below the swelling was not possible.
- Bilaterally carotid pulsations were not palpable.
- No cervical lymph nodes were palpable.
- No signs and symptoms of secondary thyrotoxicosis were present.

Investigations

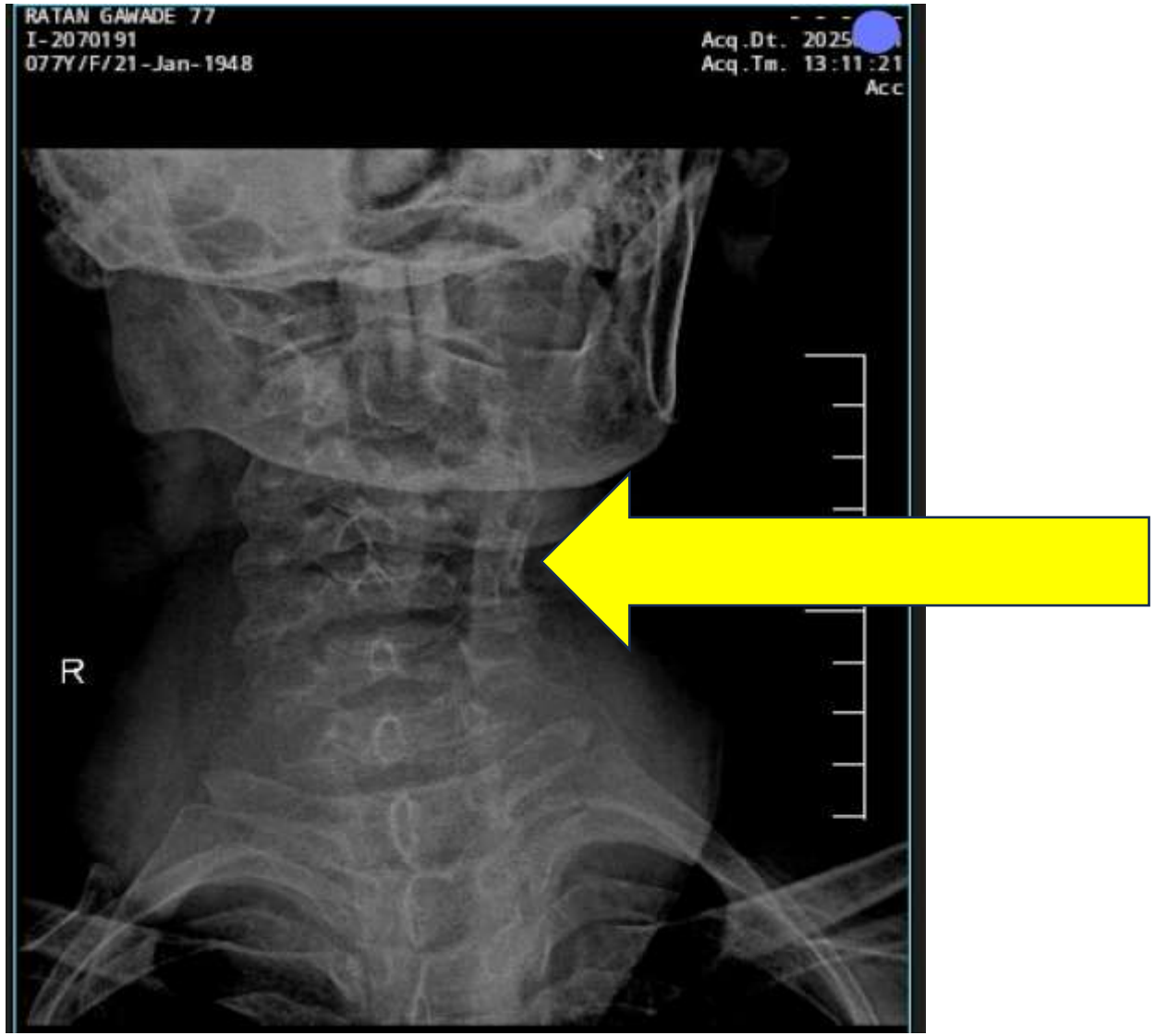
On admission , all routine blood investigations were done , all of which were within normal limits.

Sr.TSH - 1.67 mlU/ml
T3- 1.78 ng/ml
T4- 3.66 mcg/dl

S.Calcium - 8.60mg/dl

X RAY NECK

The X RAY Neck showed Tracheal deviation to the left side.

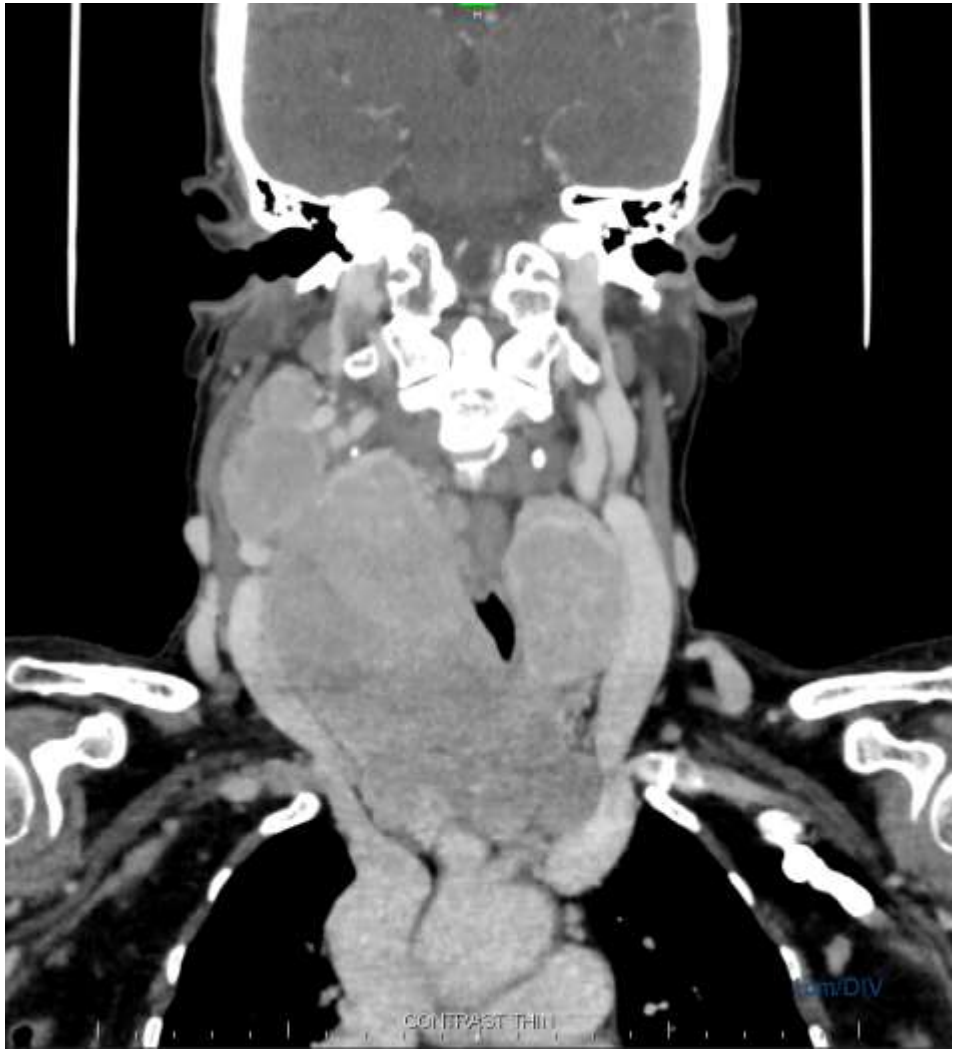


USG NECK

- Multinodular Goitre with Mass effect noted on the bilateral carotids and internal jugular veins.

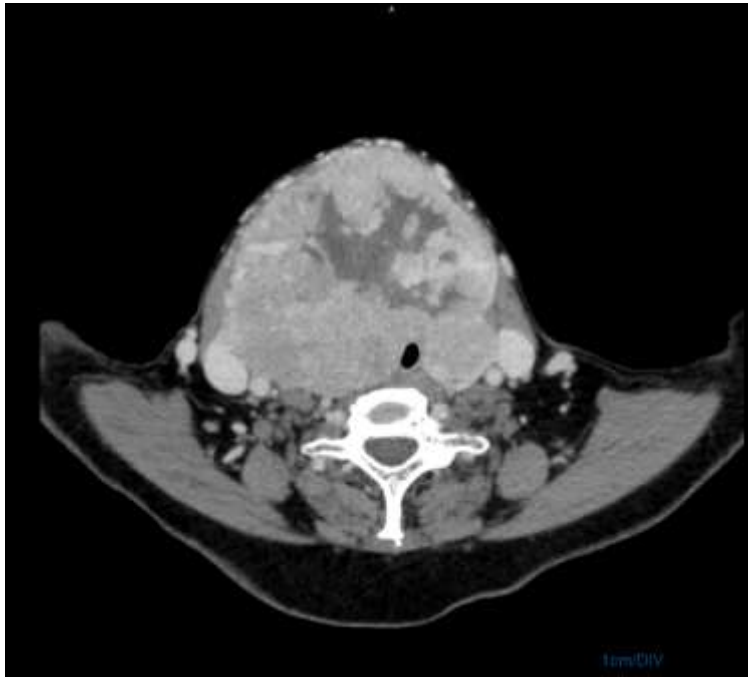
CT NECK (PLAIN AND CONTRAST)

- Both lobes of thyroid (right>>left) are enlarged in size with enlarged multiple hypodense nodules are noted in bilateral lobes of thyroid largest of size measuring 8.2 x 9.1 x 7.5 cm (AP x Tr x CC) and 3.7 x 2.9 x 6 cm (AP x Tr x CC) in right lobe of thyroid and 2.6 x 3.2 x 3.9 cm (AP x Tr x CC) in left lobe of thyroid, few calcific foci are noted within this nodule.
- It is seen causing mass effect in the form displacing the cervical part of trachea to the left and compressing it.
- Both the lobes are seen abutting the right and left internal jugular veins.



- 1) Retrosternal extension.

- 2) Tracheal compression and displacement of great vessels seen.



USG GUIDED FNAC REPORT OF THE THE THYROID MASS :

- MICROSCOPY – Multiple cellular smears studied reveals follicular cells , predominantly forming microfollicles and also singly scattered. No evidence of nuclear grooving or pseudoinclusions or optical clearing. There is no evidence of papillary formations.

- IMPRESSION – BETHESDA CATEGORY 4 – SUGGESTIVE OF FOLLICULAR NEOPLASM

- **An Indirect Laryngoscopy (IDL) and a Video Laryngoscopy (VDL) was performed :**
- B/L vocal cords were mobile.
- No phonatory gap noted.
- No growth seen.

CLINICAL DIAGNOSIS

- A case of a large follicular neoplasm in a euthyroid female.

MANAGEMENT

- A total thyroidectomy under general anaesthesia was planned for this patient.

- In this case, the team of anaesthetists anticipated a difficult intubation , hence a Fibre Optic Intubation was performed.

- During intubation a mass was visualised in the anterior aspect of the trachea , which was excised and sent for histopathology.

- A single U shaped incison was taken extending from the right mastoid process till the left mastoid process.

- In this case, a lateral approach was preffered over the midline approach, which involves accessing the thyroid gland through the space between the sternocleidomastoid and the strap muscles.

- This approach was preffered to tackle the 2 main challenges:

  1) The large size of the thyroid and its posterior extension.

  2) Its adherence to the great vessels.

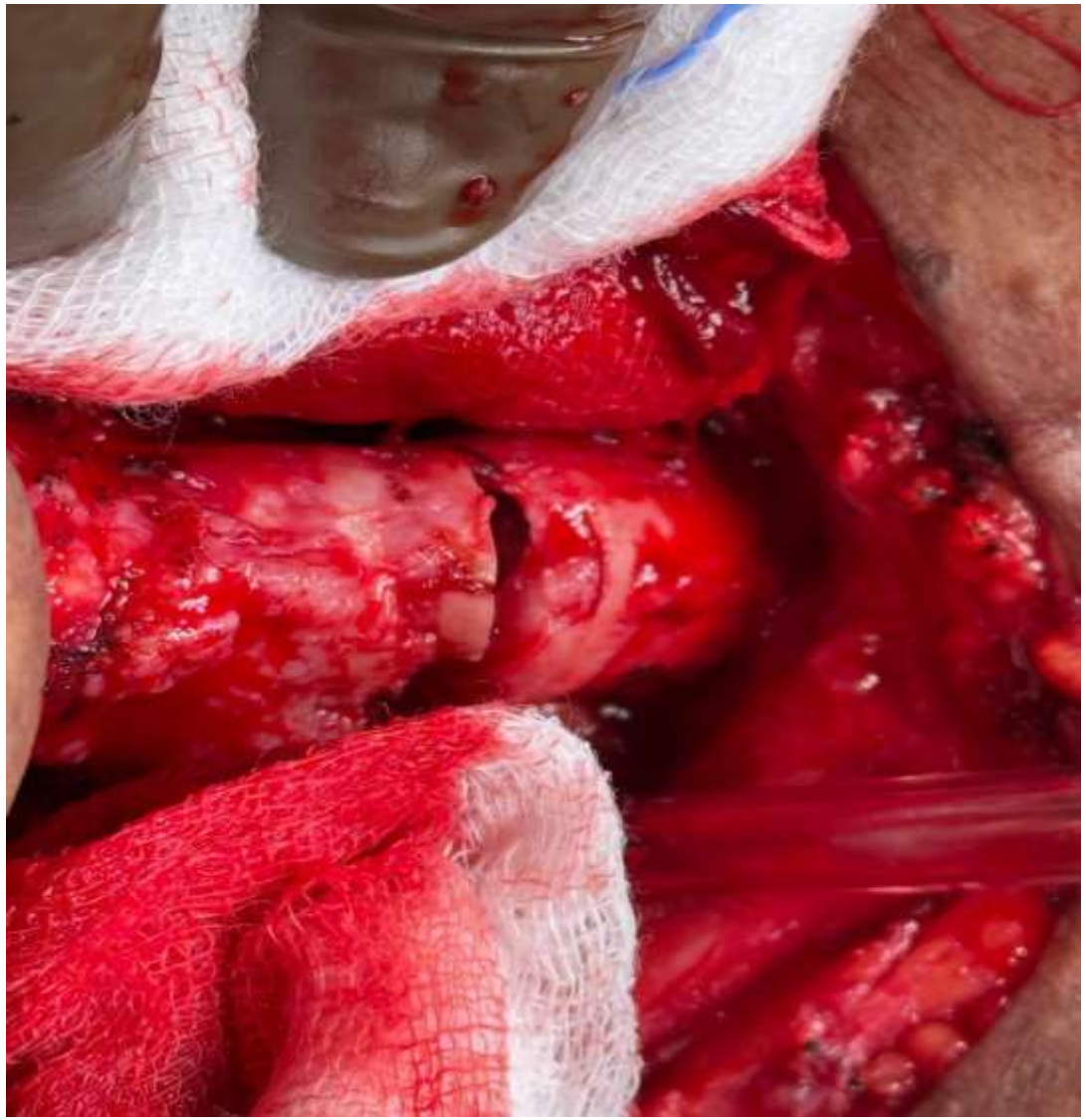
The lateral approach provides better access for dissection of the vital structures.

- The middle thyroid vein was ligated.
- The mass was separated from the Internal Jugular Veins and the Carotids.
- Due to its retrosternal extension , the lower border of the mass couldn’t be delivered into the neck.
- The lower end of the strap muscles were cut bilaterally to access the lower end of the mass.

- There was extensive blunt and sharp dissection done and individual vessels from the thorax were ligated.
- Following this slowly the thyroid was delivered into the neck.
- The recurrent laryngeal nerve and the parathyroids were preserved.

In the final step, the mass was found to be adherent to the 3rd and 4th Tracheal rings , hence an Anterior Tracheal Ring Excision was carried out, which was primarily repaired with Vicryl 3-0 interrupted sutures.

The entire specimen was sent for a frozen section , which was reported as a Follicular Neoplasm.



As the report stated it to be of a follicular variant, there was no lymph node dissection performed.

Caudal to site of the tracheal ring excision , intraoperatively a tracheostomy was performed.

- Post operatively, the patient was shifted to the SICU for monitoring.

- On POD 2, the patient was shifted back to the ward.

- The patient developed Hypocalcemia (S. Calcium – 6.70 mg/dl) , which was managed with Tablet Shelcal.

- The tracheostomy was decannulated on POD – 10, following which patient gradually started vocalising over the next 5 – 7 days and no vocal disturbances were noted.

- On POD 30, S. TSH levels were checked for the patient which were 44.09 mclU/ml.

- On POD 45 a Radio Iodine scan was done for the patient , which showed minimal uptake in the thyroid bed.

- Following which the patient is now planned for Radio Iodine Ablation Therapy.

HISTOPATHOLOGY REPORT	
HPE no. :	B/468/25

Clinical details :	C/O swelling over anterior aspect of neck since 2 years, breathlessness since 2 months. H/O Carcinoma endometrium ,operated 2 years back - USG neck (16/01/25) suggestive of multinodular goiter. CT neck (17/01/25) - Multiple heterogenous nodules in B/L lobes ; rule out MNG vs neoplastic etiology. FNAC : FN/13/25: (21/01/25) - Besthesda category IV - follicular neoplasm of right thyroid.

Nature of specimen	**Frozen remains of excised specimen of thyroid.**

Gross Examination :	Received oriented specimen of total thyroidectomy with attached threads labelled as short superior, long lateral, black thread - trachea in single tissue piece measuring 13 x 9.5 x 7.5 cm and weighing 380 gms. Right lobe measures 10.5 x 9.5 x 8.5 cm and left lobe measures 5 x 3 x 2 cm. Isthmus measures 1.5 x 0.5 cm. External surface - Enlarged, nodular with capsule intact. Cut surface - Multiple grey white solid tumour nodules identified in right and left lobes o thyroid, largest measuring 10.5 x 9 x 6.5 cm in the right lobe and smallest measuring 1 cm in diameter. One right parathyroid noted measuring 0.6 cm in diameter. Sections - A - Superior pole of right thyroid with tumor. B - Inferior pole of right thyroid with tumor. C, D - Other sections of tumor from right lobe of thyroid with isthmus. E1-E10 - Grid sections from the tumor with capsule from right lobe. F1-F5 - Extrathyroidal tissue. G - Nodule from left lobe H1- H2- other nodular areas from left lobe of thyroid with capsule. RG- I1, RG- I2, RG- I3 - Right tracheal surface with tumor. RG- J1, RG- J2 - Left tracheal surface with tumor. RG- J3 - Right parathyroid with tumor. K - Subcutaneous tissue.

Note :-

HISTOPATHOLOGY REPORT

HPE No.:	B/468/25

Microscopy :	B/468/25 , B/486/25 and B/680/25 -FINAL AMMENDED REPORT Procedure - Total thyroidectomy with bronchoscopic intratracheal mass (B/486/25) and remnant thyroid. (B/680/25) Tumor focality - Multifocal Tumor site - Right and Left lobe Tumor size - Greatest dimension - 10.5 cm. Additional dimension - 9 x 6.5 cm. Histologic type - High grade follicular cell derived differentiated thyroid carcinoma. Tumor proliferative activity - Mitotic rate - Upto 3 mitosis per 2 mm square. Tumor necrosis - Present, focal. Angioinvasion - Present. Lymphatic invasion - Present. Perineural invasion - Not identified. Extrathyroidal extension - Present, clinically/macroscopically and histologically confirmed, invades trachea (B/486/25).

Note :-

HISTOPATHOLOGY REPORT	
HPE No.:	B/468/25

Microscopy :	Regional lymph nodes - Present. Total no. of lymph nodes examined - 14. (01 lymph node from main specimen + 13 lymph nodes from thyroid remnant- B/680/25) Total no. of lymph nodes involved by invasive tumor - 1/14 (B/680/25) Extranodal extension - Identified. Distant metastasis - Not applicable. pTNM classification (AJCC 8 th edition) - mpT4a pN1 pM not applicable. Additional findings - Lymphocytic thyroiditis, single right parathyroid gland noted - Free of tumor (section J4). B/486/25 - Bronchoscopic intratracheal mass. H & E stained section studied shows bits of tissue lined by metaplastic keratinized stratified squamous epithelium. The subepithelial tissue show an infiltrating tumor arranged in follicles and sheets. The lumen of follicles show colloid.

Diagnosis :	**B/468/25, B/486/25 and B/680/25-** **High grade follicular cell derived differentiated thyroid carcinoma with extensive lymphovascular emboli, with intratracheal extension.** **pTNM classification (AJCC 8 th edition): mpT4a pN1 pM not applicable** **1 out of 14 lymph nodes is involved by tumor. Extranodal extension - Identified.** **Single right parathyroid- free of tumor.**

HISTOPATHOLOGY REPORT OF BRINCHOSCOPIC INTRATRACHEAL MASS

HISTOPATHOLOGY REPORT	
HPE no. :	B/486/25
Clinical details :	C/O swelling over anterior aspect of neck since 2 years, breathlessness since 2 months. H/O Carcinoma endometrium ,operated 2 years back - USG neck (16/01/25) suggestive of multinodular goiter. CT neck (17/01/25) - Multiple heterogenous nodules in B/L lobes ; rule out MNG vs neoplastic etiology. FNAC : FN/13/25: (21/01/25) - Besthesda category IV - follicular neoplasm of right thyroid.
Nature of specimen	**HPE of excised specimen of bronchoscopic intratracheal mass.**
Gross Examination :	Received single grey white soft tissue piece measuring 1 x 0.5 x 0.5 cm. Sections - 01 - Bisected (Submitted All).
Microscopy :	H & E stained section studied show bits of tissue lined by metaplastic keratinised stratified squamous epithelium.The subepithelial tissue show an infiltrating tumor arranged in follicles and sheets. The lumen of follicles show colloid.
Diagnosis :-	**B/468/25, B/486/25 and B/680/25-** **High grade follicular cell derived differentiated thyroid carcinoma with extensive lymphovascular emboli, with intratracheal extension.** **pTNM classification (AJCC 8 th edition): mpT4a pN1 pM not applicable** **1 out of 14 lymph nodes is involved by tumor. Extranodal extension - Identified.** **Single right parathyroid- free of tumor.**

HISTOPATHOLOGY REPORT

HPE no. :	B/680/25
Clinical details :	C/O swelling over anterior aspect of neck since 2 years, breathlessness since 2 months. H/O Carcinoma endometrium ,operated 2 years back - USG neck (16/01/25) suggestive of multinodular goiter. CT neck (17/01/25) - Multiple heterogenous nodules in B/L lobes ; rule out MNG vs neoplastic etiology. FNAC : FN/13/25: (21/01/25) - Besthesda category IV - follicular neoplasm of right thyroid.
Nature of specimen	**HPE of excised specimen of remnant thyroid tissue.**
Gross Examination :	Received single capsulated nodular mass measuring 6 x 5 x 2.5 cm. External surface - Bosselated, greyish white. Cut surface - Greyish white tumor noted entirely abutting the capsule. No normal thyroic tissue identified. Grossly 12 lymph nodes identified, appears unremarkable. Sections - A1- A5 -from nodular mass A6 - nodular mass with 1 lymph node. B1- 1 lymph node, B2- 5 lymph nodes C1- fibrofatty tissue, C2 -5 lymph nodes.

Note :-

HISTOPATHOLOGY REPORT

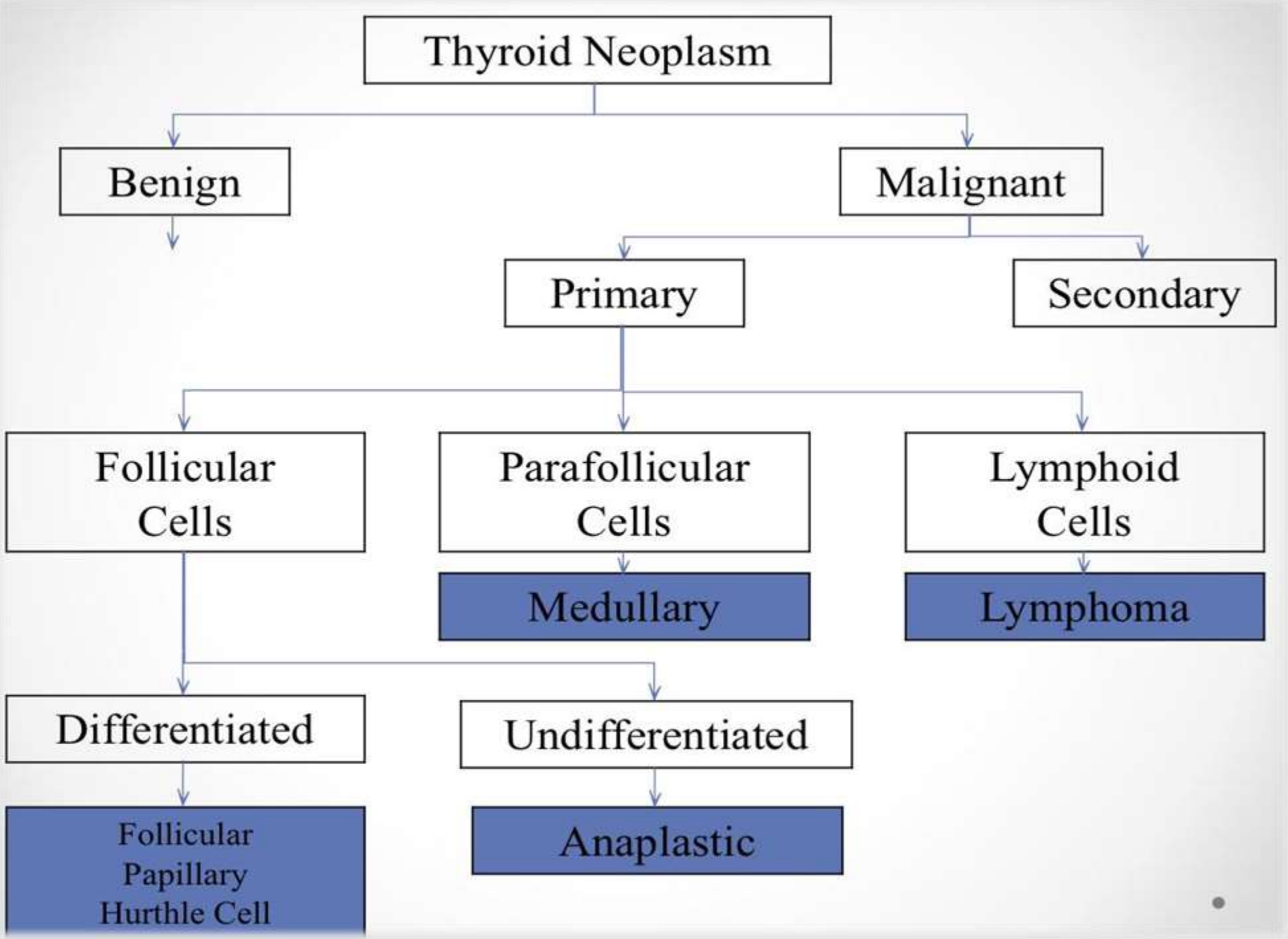
HPE No.:	B/680/25
Microscopy :	Seen by Dr. Sushama Gurwale (Asso Prof) Multiple H and E stained sections studied shows 13 lymph nodes. One of the lymph node shows an infiltrating tumor arranged in nests, insular pattern and follicles . The tumor nests are predominantly solid at places forming microfollicles. Minimal colloid noted within the follicles. The individual tumor cells have round hyperchromatic nuclei, indistinct nucleoli and clear to eosinophilic cytoplasm. Also seen are areas of tumor necrosis , fibrosis and cholesterol clefts. Size of largest metastatic deposit- 6.0 cm Extra nodal extension- identified.
Diagnosis :-	**One out of 13 lymph nodes (01/13) shows metastasis of high grade follicular cell derived differentiated thyroid carcinoma.**

DISCUSSION

- Thyroid cancer is the most common endocrine malignancy.
- The incidence has been rising, particularly in women (3:1 ratio compared to men).

RISK FACTORS

- Genetic: Family history of thyroid cancer, medullary thyroid cancer (MTC) linked to RET proto-oncogene mutations (often in MEN 2 syndrome).
- Environmental: Radiation exposure (especially in childhood) is a significant risk factor
- Sex: Women are more likely to develop thyroid cancer, particularly in the younger age group.
- Iodine deficiency: Less common in iodine-replete regions, but a notable risk in iodine-deficient areas.


Thyroid Neoplasm
Benign
Malignant
Primary
Secondary
Follicular Cells
Parafollicular Cells
Lymphoid Cells
Medullary
Lymphoma
Differentiated
Undifferentiated
Follicular
Papillary
Hurthle Cell
Anaplastic

DIFFERENCES BETWEEN PAPILLARY AND FOLLICULAR THYROID CANCER

Incidence

- Papillary Thyroid Cancer (PTC):Most common type of thyroid cancer (70-80% of cases).More commonly diagnosed in younger patients, particularly women.

- Follicular Thyroid Cancer (FTC):Accounts for 10-15% of thyroid cancers.More common in older adults.Gender distribution is more even compared to PTC, but still slightly more common in women.

Spread/Metastasis

- Papillary Thyroid Cancer (PTC):Lymphatic spread is common, especially to cervical lymph nodes.Distant metastasis is rare but can occur to the lungs and bones, often in advanced cases.

- Follicular Thyroid Cancer (FTC):More prone to hematogenous spread, particularly to the lungs and bones.Lymphatic spread is much less common than in PTC.

- Follicular thyroid cancer (FTC) with tracheal invasion is a rare and challenging clinical scenario.

- A retrospective review of 597 patients undergoing thyroidectomy for thyroid cancer identified 40 cases (approximately 6.7%) with laryngotracheal invasion.

- Among these, only two cases (5%) involved FTC, with the majority being papillary thyroid carcinoma.

- Management approaches vary based on the extent of invasion:

- Superficial Invasion: Patients with superficial tracheal invasion often undergo cartilage shave procedures combined with adjuvant radiotherapy. In a study, 35 patients with superficial invasion received this approach, resulting in a 10-year disease-free survival rate of 47.9%

- Full-Thickness Invasion: For cases with full-thickness tracheal invasion, more extensive surgical interventions are necessary. The same study reported that five patients with full-thickness invasion underwent radical resections, including tracheal sleeve resection (n=3) and total laryngectomy (n=2).

- A review of 48 patients with tracheal invasion by various thyroid carcinomas found that postoperative I-131 treatment and radiotherapy enhanced the 5-year survival rates across different invasion groups.

- While FTC with tracheal invasion is uncommon, a combination of surgical resection tailored to the invasion's extent and postoperative therapies like radioactive iodine and radiotherapy can lead to favorable survival outcomes.

- The exact prevalence of FTC with retrosternal extension is not well-documented.

- A study involving 2,426 patients with retrosternal goiter (RSG) classified the extension into three grades:

- Grade 1: Extension above the aortic arch.
- Grade 2: Extension from the aortic arch to the pericardium.
- Grade 3: Extension below the right atrium.

- Management strategies depend on the extent of retrosternal extension:
- Grade 1 (Above Aortic Arch): Typically managed via a cervical approach.

- Grade 2 (Aortic Arch to Pericardium): May require a combined cervical and manubriotomy approach.

- Grade 3 (Below Right Atrium): Often necessitates a cervical approach combined with sternotomy.

CHALLENGES FACED IN THIS CASE :

1) The size of the thyroid swelling and its posterior extent.

2) Retrosternal extension.

3) Adherence to vessels.

4) Preservation of the parathyroids and the laryngeal nerves.

5) Tracheal involvement.

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- Grillo H.C., Suen H.C., Mathisen D.J. *et al.* (1992) Resectional management of thyroid carcinoma invading the airway. *Ann. Thorac. Surg.* **54**, 3–10
- Gaissert H.A., Honings J., Grillo H.C. *et al.* (2007) Segmental laryngotracheal and tracheal resection for invasive thyroid carcinoma. *Ann. Thorac. Surg.* **83**, 1952–1959
- Friedman M., Danielzadeh J.A. & Caldarelli D.D. (1994) Treatment of patients with carcinoma of the thyroid invading the airway. *Arch. Otolaryngol. Head Neck Surg.* **120**, 1377–1381
- Ito Y., Fukushima M., Yabuta T. *et al.* (2009) Local prognosis of patients with papillary thyroid carcinoma who were intra-operatively diagnosed as having minimal invasion of the trachea: a 17-year experience in a single institute. *Asian J. Surg.* **32**, 102–108

- THANKYOU

- Laryngoscopy can detect paralyzed vocal cord cases without voice change.
- Neck CT scan is used to evaluate the invasion of surrounding structures when tracheobronchoscopy is applied to access the invasive extent of airway lumen.
- The most common staging system applied to evaluate the extent of tracheal invasion in aggressive thyroid cancer is the classification described by Shin and McCaffrey

	Shin et al. [8]	McCaffrey [14]
I	Extension through the capsule of the thyroid gland and abutting the external perichondrium	Tumor locates entirely intrathyroidal gland without airway or surrounding muscle invasion
II	Invasion into the cartilage or the cartilaginous layer or destruction of the cartilage	Tumor invades the perichondrium of the aerodigestive tract or firmly abuts the muscle but does not invade into the cartilage or deeply into muscle
III	Extension into the lamina propria of the tracheal mucosa without epithelial invasion	Tumor invades through the airway perichondrium and into the cartilage or deeply into muscle but not into the submucosa
IV	Invasion into or beyond the trachea	Tumor invades through the perichondrium and cartilage or through the muscle and deforms the submucosa but does not penetrate the mucosa
V		Tumor is gross transmucosal involvement

- Regarding thyroid cancer, tracheal resection could be performed by the following procedures:

1. **Shave procedures.**
2. **Segmental/partial resection and direct closure.**
3. **Partial resection together with reconstruction of musculocutaneous flap or cartilage graft.**
4. **Total laryngectomy and permanent tracheotomy.**

- For stages II and III according to McCaffrey, the resection of all gross tumors can be performed by “shave procedures” meaning the removal of a partial thickness of the airway tract wall.
- Several retrospective studies comparing radical resection and shave procedures combined with RAI showed no survival benefit in the patients undergoing radical resection.
- Similarly, Segal et al. also reported no difference in 5-year survival between two methods.

- For stages IV and V according to McCaffrey, the surgery can be performed by either window resection or circumferential tracheal resection.
- The “Window resection” method is appropriate for limited involvement of only anterior or lateral wall of trachea.
- The defect can be reconstructed by a primary closure, with strap muscles, sternocleidomastoid muscle, or latissimus dorsi musculocutaneous flap.

- Tumor invading extensively the anterolateral tracheal wall can be removed by segmental resection and primary end-to-end anastomosis.
- The maximum length of segmental tracheal resection is 5-6 cm, which is considered to be adequate for primary anastomosis without tracheal or laryngeal mobilization.
- In cases that both anastomosis and reconstruction could not be implemented, permanent tracheotomy is inevitable.

- The postoperative complication rate after tracheal resection with direct closure ranges from 15% to 39%, and postoperative mortality rate is roughly 1.2%.
- The common complications after advanced thyroid carcinoma treatment include anastomotic dehiscence, airway stenosis, infection, and bleeding.
- The anastomotic dehiscence is one of the most serious complications, which can be life-threatening. This complication is related to the length of the tracheal segment resected over 5-6 cm.

- To reduce the tension of the anastomotic trachea, the neck of patient is fixed either in a “chin-to-chest” position during the 6^{th} to 7^{th} postoperative day or by a C-collar.

Fine Needle Aspiration Cytology Report

FNAC no. :	FN/13/25
Site of FNAC :	**USG guided FNAC of right thyroid mass.**
Impression :	**Bathesda category IV - Suggestive of follicular neoplasm - Right thyroid**
Advice:	Correlate with radiological findings.

Clinical Details :	Patient was apparently alright 2 yeras back when she developed a swelling in the anterior aspect of neck, which was insidious in onset and gradually progressive in nature, not associated with pain. There is complain of breathlessness at rest. Patient is a K/C/o uterine cancer since 2 yeras for which hystectomy. No history of difficulty in swallowing , change in voice or loss of weight. No history of DM,HTN,Asthma,TB or TB contact. No significant family history.
Local Examination :	Patient was not available for examination.
Nature of Aspirate & Number of Slide	Received 4 blood tinged USG guided FNAC smears - 2HE, 2L.
Microscopy :	Multiple cellular smears studied reveals follicular cells predominantely forming microfollicles and also singly scattered. Nuclear overcrowding noted at places. However, there is no evidence of nuclear grooving or pseudoinclusions or optical clearing. There is no evidence of papillary formations.
Note :	