Thyroid Cancer: Radioiodine Therapy and Dosimetry Nuts and Bolts

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Disclosures

- Consultant to Jubilant Radiopharma

Objectives

- 1. Understand the conditions under which radioiodine therapy dosimetry would be warranted.
- 2. Become familiar with radioiodine therapy dosimetric imaging and calculation methods.
- 3. Be able to discuss the three main categories of radioiodine treatment in thyroid cancer.
- 4. Be able to discuss the physiological basis and use of I-131 in the treatment of well-differentiated thyroid cancer (DTC).

SAM Questions

- 3. When is the optimal timing to perform post therapy scans?
- A. 1-2 days
- B. 3-7 days
- C. 9-11 days
- D. 13-15 days

SAM Questions

- 4. Which of the following is a known early side effect of I-131 therapy?
- A. Sialadenitis
- B. Bone marrow suppression
- C. Permanent sterility
- D. Radiation-induced carcinogenesis

Differentiated Thyroid Cancer

- Differentiated thyroid cancer (DTC):
- Includes papillary, follicular and Hurthle cell cancers
- Does not include medullary or anaplastic thyroid cancer

- Should DTC be called functioning thyroid cancer?

Benefits of I-131 Therapy for DTC

- Solid evidence over many years of clear benefit from I-131 therapy.
- I-131 therapy has clearly shown disease-specific survival and overall survival.
- Refs: Jonklaas, et al. Thyroid. 2006(12):1229-1242
- Carhill, et al. J Clin Endocrinol Metab, Sept. 2015 NTCTCS
- Verburg, et al. JCEM 2014; 99:4487-4496
- Ruel, et al. JCEM 2015; 200:1529-1536
- Mazzaferri and Kloos. 2001;86(4):1447-1463
- I-131 therapy is clearly superior to external beam radiation.
- Ref: Yang, et al, Thyroid 2017: 27(7):944-952
- Courtesy of Anca Avram, MD

Standard of Care for Differentiated Thyroid Cancer

- First: Diagnosis
- Next: Subtotal/near total thyroidectomy
- Postoperative management:
- 1) thyroglobulin measurement,
- 2) neck ultrasound,
- 3) diagnostic whole-body scintigraphy (with I-131 or I-123) – assists in characterizing tumor I-131 avidity, identifies extent of disease.

Standard of Care for Differentiated Thyroid Cancer

- 4. Post therapy whole body scintigraphy (utilizing the I-131 given for therapy). This scan assists in characterizing tumor I-131 avidity and identifies extent of disease.
- This scan is critically important for evaluation of disease status and determination of follow-up treatment, especially administered activity of ^{131}I.
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Standard of Care for Differentiated Thyroid Cancer

- Postoperative I-131 therapy:
- Goal is determined largely by clinical and pathologic findings, laboratory values, and information from imaging.

- Refs:
- 1. Avram A, et al, 2022; J Nucl Med. 63(2):189-195.
- 2. Van Nostrand D, 2009; Thyroid. 19;1381-1391.

Standard of Care of Differentiated Thyroid Cancer

- There are two main techniques to I-131 therapy:
- 1. Theranostic technique – utilizes the information derived from the postoperative whole body scan
- 2. Risk-based or empiric approach based on clinical-pathologic factors and institutional protocols.

- Each of these techniques has strengths and limitations. However, I think the theranostic approach will ultimately prevail.

Theranostics

- Definition of Nuclear Theranostics:
- Theranostics is a portmanteau word derived from the terms *therapeutics* and *diagnostics.*
- Nuclear Theranostics is the pairing of diagnostic biomarkers and therapeutic agents that share the same or similar molecular structure and identify (diagnostic agent) and treat (therapeutic agent) the same molecular target.
- This commonality should improve patient selection, prediction of response and toxicity, prognosis, and ultimately, improve outcomes.
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Standard of Care for Differentiated Thyroid Cancer

- I-131 therapy (Overall term: **therapy**)
- Types of I-131 treatments are classified as follows (as defined by the American Thyroid Association [ATA]):
- Remnant ablation
- Adjuvant treatment
- Treatment of known disease

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Types of I-131 Treatments

- Post diagnosis and post surgery I-131 treatment is classified as follows:
- **Remnant ablation –** eliminate normal thyroid tissue. Purpose: facilitates follow-up by improving subsequent detection of residual or recurrent disease.
- **Adjuvant treatment –** to irradiate suspected but unproven sites of malignancy. Purpose: reduce risk of recurrence and prolong survival.
- **Treatment of known disease** (persistent or recurrent, locoregional or metastatic)
- Diagnostic scan (including with SPECT/CT) – may be helpful
- Post therapy scan – essential/critically important – to assess presence and severity of metastatic disease, provides basis for subsequent ^{131}I therapy.
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Types of I-131 Treatments

- 1) **Remnant ablation**
- Process of eliminating residual (postoperative) normal thyroid tissue. Rationale: functioning tumor is less efficient than normal thyroid at organifying iodine and producing thyroid hormone.
- Goals: reduce serum thyroglobulin to an undetectable level, which will facilitate follow-up and early detection of recurrence
- Also enables high sensitivity post-therapy whole body scintigraphy for diagnosis and localization of residual tumor postoperatively.
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Types of I-131 Treatments

- 2) **Adjuvant treatment**
- Goal: Treat suspected microscopic but unproven sites of metastasis, based on histopathologic risk factors that predict tumor dissemination beyond the thyroid gland.
- Purpose: reduce risk of recurrence and provide prolonged survival.

- **There is commonly overlap of remnant ablation and adjuvant treatment**
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Types of I-131 Treatments

- 3) **Treatment of known disease** (persistent or recurrent, locoregional or metastatic)
- Goal: Treatment of regional or distant metastatic disease to eliminate iodine-avid regional disease or distant metastasis to achieve cure or remission, reduce recurrent or persistent disease, and improve overall prognosis and survival.

Remnant Ablation

- By definition, remnant ablation is the complete elimination (or destruction) of all normal thyroid tissue.
- Purpose: since normal thyroid is more efficient at uptake of iodine, removing normal tissue will facilitate detection of residual or recurrent tumor.
- Remnant ablation with I-131 is considered a safe and effective method for eliminating residual normal thyroid tissue.
- Ref: Bal CS and Padhy AK. World J Nucl Med. 2015; 14(3):144-155
- 16

Remnant Ablation

- Remnant ablation is generally performed 4-6 weeks following subtotal/near total thyroidectomy.
- Substantial controversy regarding how much administered activity for remnant ablation.
- Some advocate 30-50 mCi. [**I think this is too low**.]
- However, some NM physicians use 100 -150 mCi.

Remnant Ablation

- 30 mCi vs. 100 mCi.
- Post-surgical thyroid ablation with low or high radioiodine activities results in similar outcomes in intermediate risk DTC patients.
- Low = 30-50 mCi, High = 100 mCi or greater
- Conclusion: **In DTC patients at intermediate risk**, high RAI activities given for ablation have no major advantage over low activities.
- Ref: Castagna MG, et al, Eur J Endo. 2013; 169:23-29

- "30 mCi is equally as **effective** as 100 mCi"
- "30 mCi is equally as **ineffective** as 100 mCi"

Remnant Ablation

- **However, the important consideration is absorbed dose, not how many mCi are given**.
- Absorbed dose depends on administered activity, % uptake, and remnant mass.
- The absorbed dose necessary to provide remnant ablation is generally thought to be 300 Gray (Gy) = 30,000 rad.
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Ref: Maxon, et al. NEJM. 1983; 309:937-941

Courtesy of D. Van Nostrand

A Possible Risk-Based Strategy for RAI Therapy for DTC

- Activities listed below are one set of recommendations
- Remnant ablation – 30-150 mCi (1.11-5.55 GBq)
- Adjuvant treatment – 100-150 mCi (3.7-5.55 GBq)
- Small volume locoregional disease – 100-150 mCi (3.7-5.55 GBq)
- Advanced locoregional disease or small volume distant metastases – 150-200 mCi (5.55-7.4 GBq)
- Treatment of extensive distant metastatic disease- >200 mCi (>7.4 GBq), to maximum tolerated safe I-131 activity
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Standard of Care for Differentiated Thyroid Cancer

- Postoperative I-131 therapy:
- Goal is determined largely by clinical and pathologic findings, laboratory values, and information from imaging.

- Refs:
- 1. Avram A, et al, 2022; J Nucl Med. 63(2):189-195.
- 2. Van Nostrand D, 2009; Thyroid. 19;1381-1391.

Whole-body Diagnostic Scintigraphy (WBS)

- Obtain postoperative/pretherapy whole body diagnostic scan with I-131 (or I-123 or I-124) to identify and localize regional and distant metastases and determine the RAI-avidity of these lesions. This information is used in planning subsequent I-131 treatment.
- **Warning** – these scans frequently do not detect all lesions.
- Management may be altered due to findings on the diagnostic whole body scan (findings may alter activity of administered I-131 or avoid unnecessary I-131 treatment).
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Whole-body Diagnostic Scintigraphy (WBS)

- Use of SPECT/CT with the postoperative diagnostic scan may provide additional useful information, such as:
  a. distinguishing thyroid remnant from nodal metastasis,
  b. detecting metastasis in normal-sized cervical lymph nodes,
  c. detecting pulmonary micrometastases or bone metastases.
  d. provide information for dosimetry.

Whole-body Diagnostic Scintigraphy (WBS)

- Postoperative diagnostic scan may not detect all or any lesions, and enhancement may be a useful next step.
- Postoperative diagnostic scan may provide information that would indicate additional functional metabolic imaging, such as F-18 FDG PET/CT when non-avid RAI metastatic disease is suspected.

Whole-body Diagnostic Scintigraphy (WBS)

- Post therapy whole body diagnostic scans (WBS) with I-131 can be performed at 2-10 days post I-131 treatment. Optimal timing is 5-7 days post I-131 treatment.
- Post therapy scans are critically important for localization and evaluation of regional or distant metastases and planning for subsequent I-131 therapy.

Appropriate Use of I-131 in Differentiated Thyroid Cancer (DTC)

- The following scenarios after DTC diagnosis are “appropriate”:
- Initial staging for malignant iodine-avid (IA) thyroid tissue after thyroidectomy
- Assessing and quantifying residual IA remnant tissue
- Posttherapy I-131 localization performed 2-10 days after radioiodine therapy (3-5 and/or 5-7 days are optimal)
- Follow-up/diagnostic/restaging evaluation scan
- Follow-up/diagnostic/restaging eval scan to determine if a structural lesion is IA
- “May Be Appropriate”:
- Follow-up/diagnostic/restaging scan with prior negative results of ^{131}I posttherapy images

Dosage and Protocol Selection - DTC

- Diagnostic scan prior to I-131 therapy for thyroid cancer - 1-5 mCi
- 1-2 mCi of I-131 is best to avoid the rare complication of stunning.
- Diagnostic scan using I-123 – avg 275 microcuries
- Post therapy scan (use of the therapeutic administration for the scan - no additional administered activity is necessary). This is critically important for evaluation of disease status and determination of follow-up treatment, especially administered activity of ^{131}I.
- **Pregnancy and lactation are absolute contraindications to I-131 therapy**

Risk Stratification – Risk of Structural Disease Recurrence

- Low risk – Intrathyroidal DTC, ≤5 LN (<0.2 cm)
- Intermediate risk – Aggressive histology, minor extrathyroidal extension, vascular invasion, >5 LN (0.2-3 cm)
- High risk – Gross extrathyroidal extension, incomplete tumor resection, distant metastases, or LN >3 cm

- Accurate staging and risk assessment post surgery are essential for optimizing patient management.
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Factors Determining Prescribed Therapeutic I-131

- Treatment objectives (cure, progression free survival, palliation)
- Time interval since previous I-131 treatment
- Amount of I-131 administered for the most recent treatment
- Response to the most recent treatment
- Total cumulative therapeutic activity of I-131
- Frequency and severity of side effects from previous I-131 treatments
- Take into account patient wishes and concerns
- Capabilities of the treating facility
- Regulations – Federal, State, Local

2 Main Approaches to I-131 Therapy

- 1) A. Dosimetric or Theranostic approach. Combines the information obtained from postoperative diagnostic RAI scans (using I-131 or I-123) in planning I-131 treatment. Warning – diagnostic scans have reduced sensitivity compared to post I-131 therapy scans.
- B. Maximum tolerated activity – maximum exposure to bone marrow.
- 2) Risk-based approach, which utilizes clinical-pathologic factors and institutional protocols to determine I-131 treatment.
- "Currently, no conclusive evidence as to which approach will result in better outcomes." – **INCORRECT!!**
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I-131 Therapy

- "Currently, no conclusive evidence as to which approach will result in better outcomes" (i.e., survival). **- INCORRECT**
- However, there is published data showing that use of dosimetry can minimize side effects to bone marrow.

- Refs:
- 1. Kulkarni, et al. Thyroid 2006; 16:1019-1023
- 2. Esposito, et al. J Nucl Med 2006; 47:238P

I-131 Therapy

- Published data demonstrating improved clinical response of metastases using dosimetric approach.
- Metastases in dosimetric group were 70% less likely to progress. Advantage was specifically apparent in locoregionally advanced group.

- Ref: Klubo-Gwiezdzinska J, et al. Efficacy of dosimetric versus empiric prescribed activity of I-131 for therapy of differentiated thyroid cancer. J Clin Endocrinol Metab. 2011; 96(10):3217-3225
- Courtesy of D. Van Nostrand, MD

I-131 Treatment – Lesional Dosimetry

- Determination of minimal administered activity to achieve desired therapeutic outcome:
- At least 8,000 rad to prevent progression of metastases.
- Improved therapeutic response based on lesional dosimetry.

- Ref: Maxon, et al. NEJM. 1983; 309:937-941
- Plyku D, et al. Annals of Nuclear Medicine. 2022; 36(3):213-223

Courtesy of D. Van Nostrand, MD

I-131 Treatment

- Early identification of regional and/or distant metastases may allow for successful I-131 treatment which likely will improve outcomes.
- Postoperative whole body RAI scintigraphy (WBS) predicts localization of therapeutic I-131 and is important for planning for I-131 therapy.

I-131 Therapy

- Risk-based or risk-adapted approach
- Administered activity is chosen according to the goal of therapy and the estimated risk of persistent or recurrent malignancy.
- Based on several factors, including local protocols, experience and availability of patient-related parameters, and imaging modalities.

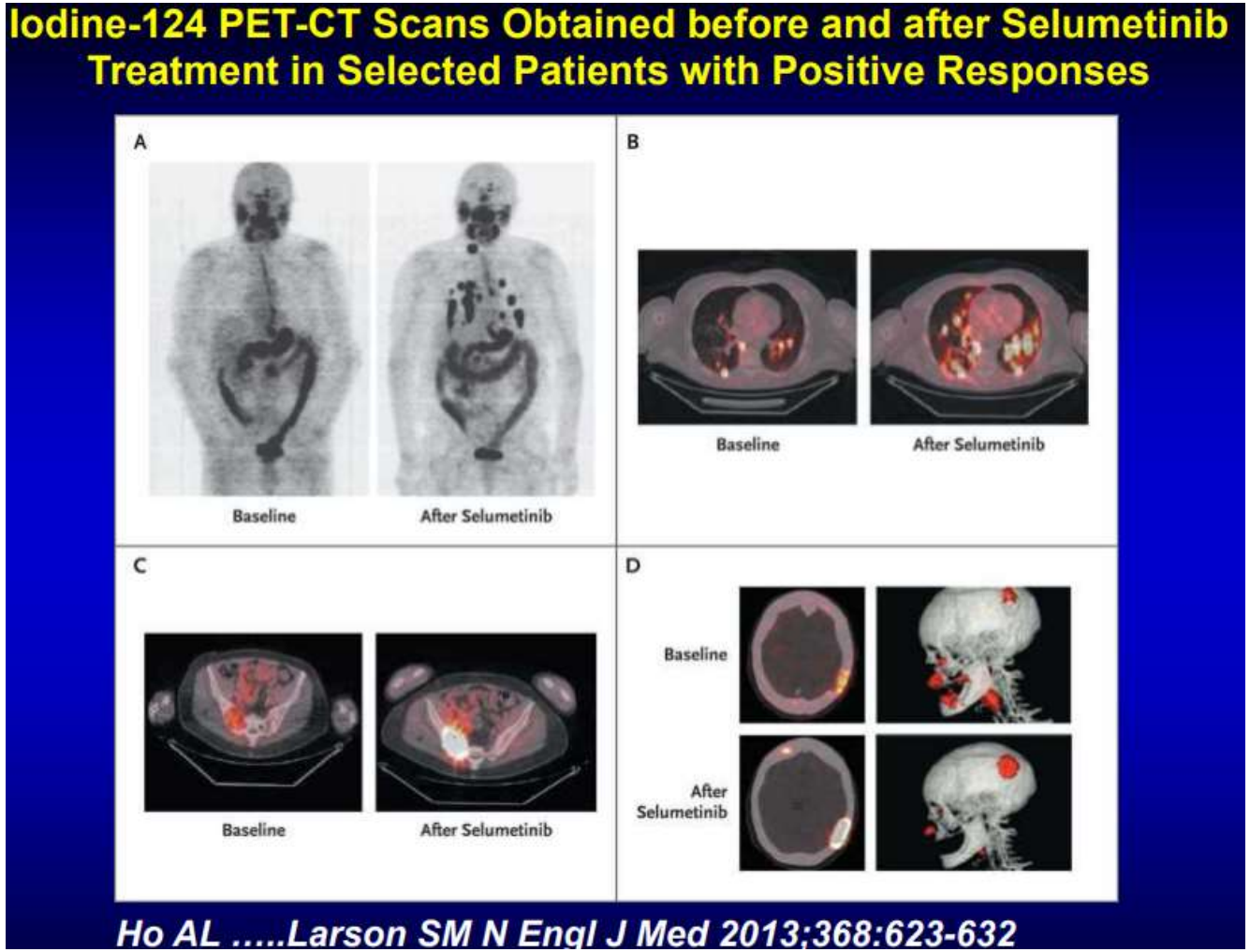
I-131 Treatment – Risk-Based Approach with Dosimetry

- Prescribed activities of I-131 treatment were listed previously
- In diffuse, homogeneous lung metastases, whole body dosimetry is required so that the prescribed administered activity of I-131 results in retention in the lungs of less than 80 mCi (3 GBq) at 48 hours to avoid the complication of pulmonary fibrosis (which can be a fatal complication)

Response assessment after primary treatment

- Whole Body Scan 1-2 years after primary treatment
- Used to re-stratify risk of recurrence
- Dynamic risk stratification – predictive of long-term clinical outcome
- Patients with an excellent (complete response) to I-131 treatment have a 1-4% chance of recurrence, a reduction of risk from 36-43% in intermediate risk patients, and from 68-70% in high-risk patients.

Enhancement of Theranostic Performance



Courtesy of Richard Baum, MD

Theranostic performance with RAI can be enhanced

- Oncobiology of thyroid cancer decreases theranostic power of RAI
- Selumetinib enhances iodine incorporation in patients with I-131 refractory thyroid cancer and reverses I-131 resistance.
- Selumetinib effects upon iodine incorporation may be dependent on clinical factors and/or tumor genotype.
- Ref: Ho et al: N Engl J Med. 2013 Feb 14; 368(7):623-632. doi:10.1056/NEJMoa1209288

- Selumetinib, Trametinib – MEK inhibitor
- Dabrafenib, Vemurafenib - BRAF inhibitor
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I-131 Treatment of advanced disease

- Distant metastases develop in approximately 10% of patients
- Prognosis is variable –
- In some patients, the disease is indolent;
- In some patients the disease is aggressive
- Patients with RAI-avid metastatic disease have a much better prognosis (>90% 10-year survival) than patients with non-iodine-avid metastases (10% 10-year survival).
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Use of genomics in Treatment of DTC

- Most common mutation of papillary thyroid CA is BRAF.
- BRAF mutations degrade ability of malignant thyroid tissue to take up RAI.
- Follicular thyroid CA more often has RAS mutations. These mutations degrade uptake of RAI by malignant thyroid cells, but less than BRAF tumors.

Acute Side Effects of I-131 Therapy

- Uncomfortable, rarely lethal; usually minimal and transient:
- Neck tenderness and swelling
- Painful stomatitis and glossitis
- Sialadenitis - protective measures – hydration, lemon candies or lemon juice
- Xerostomia
- Dysgeusia
- Reduced salivary gland function
- Mild temporary bone marrow suppression

Acute/Intermediate Side Effects of I-131 Therapy

- Radiation gastritis and enteritis
- Radiation thyroiditis (inadequate total thyroidectomy)
- Xerostomia
- Dysgeusia
- Reduced salivary gland function
- Mild temporary bone marrow suppression
- Transient infertility
-

Potential Chronic Side Effects of I-131 Therapy

- Permanent sterility
- Chronic xerostomia and painful sialadenitis with sialolithiasis
- Epiphora – excessive tear production (can be due to irritation or nasolacrimal duct obstruction)
- Radiation-induced pulmonary fibrosis
- Bone marrow suppression – pediatric
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Long Term Side Effects of I-131 Therapy for Thyroid Cancer

- Radiation fibrosis: may develop in pts with diffuse lung metastases who have received over 5.55 GBq (150 mCi) at short intervals.
- Ref: Rubino, et al. Br J Cancer. 2003: 89:1638-1644

- Beierwaltes: Radiation fibrosis in pts with miliary lung metastases (which can have uptake up to 40%) does not occur if I-131 treatment is kept below 200 mCi, so the lung uptake is <80 mCi.
- Personal communication – George Wilson, MD

Mortality – I-131 Therapy vs. External Beam Therapy

- 11,832 pts (PTC: 91.24%, FTC: 8.76%)
- All cause mortality:
- PTC cohort:
- 5y mortality: 22.7% w/o RAI vs. 11.0% w adjuvant RAI
- 10y mortality: 25.5% w/o RAI vs. 14.0% w adjuvant RAI
- FTC cohort:
- 5yr mortality: 45.5% w/o RAI vs. 29.2% w adjuvant RAI
- 10yr mortality: 51% w/o RAI vs. 36.8% w adjuvant RAI

- Ref: Yang et al, Thyroid 2017; 27(7):944-952. Comparison of Survival Outcomes Following Postsurgical RAI Versus External Beam Radiation in Stage IV DTC

Long Term Side Effects of I-131 Therapy

- Significant concern:
- Second primary malignancy
- Statistically significantly higher [but still small - BG] risk of leukemia in patients with cumulative exposure of > 37 GBq (1000 mCi). Ref: Mazzaferri and Kloos JCEM 2001;86(4):1447-1463
- This is especially true if there has been exposure to external beam radiotherapy.
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Risk of Second Primary Malignancy post RAI Therapy

- 29,231 DTC pts (papillary and follicular thyroid CA)
- 18,882 treated without RAI (mean follow up: 55.5 months)
- 10,349 with RAI (I-131). (mean follow up: 61.8 months)
- Second primary malignancy (SPM):
- 6.7% without RAI,
- 4.8% with RAI
- Conclusion: Use of RAI does not elevate risk of SPM

- Ref: Bhattacharyya and Chien. Ann Otol Rhinol Laryngol. 2006; 115:607-610

Long Term Side Effects

- 834 pts administered I-131 for therapy for thyroid cancer, compared to 1121 pts treated by other means
- Admin activity avg was 4551 MBq (123 mCi)
- Radiation dose to various organs est. 0.1 - 2.1 Gy
- Risk of thyroid cancer, other solid cancer or leukemia was not associated with administered I-131.

- Ref: Hall, Holm, Lundell, et al. Cancer risks in thyroid CA patients. Br. J. Cancer 1991; 64:159-163.
-

Second Primary Malignancy (SPM) after Radioactive Iodine Treatment

- "Risk of SPM in thyroid cancer survivors treated with RAI is slightly increased compared to those not treated with RAI."
- No solid tumor was elevated, but there was an elevated relative risk of leukemia. Excess absolute risk is small.
- Limitations: 1. minimum latent period for all SPM 2-3 yrs (too short for solid tumors). 2. Numbers don't add up. – Claim 7-8% in 5-10 yrs (very high), absolute risk is 1%.
- Leukemias – 68/30,278 (0.23%). Estimate of absolute risk of leukemia is 0.23% - 0.26%, 0.4% higher in pts treated with RAI.
- 3. Limited follow-up time and pts lost to follow-up.
- 4. Unable to evaluate cumulative RAI dose and risk of SPM.
- Ref: Sawka, et al, Thyroid 2009; 19(5):451-457 DOI: 10.1089/thy.2008.0392

Risk of Second Primary Malignancy (SPM)

- Supposition by some investigators:
- Incidence of SPM is increased in DTC, not due to long-term effect of RAI therapy, but may be due to common etiologic and/or genetic factors.

- Refs: Verkooijen et al, Eur J Endocrinol. 2006; 155:801-806
- Subramanian, Goldstein, Thyroid. 2007; 17:1277-1288

Risk of Second Primary Malignancy

- Follow up studies in Sweden, United Kingdom, Denmark and Finland. – No increase in second primary malignancy.
- United Kingdom study (of 258 pts) showed a statistically significant increase in leukemia. -

Risk of Second Hematologic Malignancy

- Seo, Cho, Chung, Kim. Thyroid 2015; 25(8):927-934:
- Increased Risk of leukemia After RAI therapy in Patients with Thyroid cancer: A Nationwide, Population-Based Study in Korea
- 542,845 person-year follow up Jan 2008 - Dec 2013
- 211,360 thyroid cancer pts - 72 (0.03%) pts developed leukemia during follow up – median 877 days (2.4 years). Higher treatment dosages resulted in higher incidence of leukemia, especially > 100 mCi.
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Risk of Second Hematologic Malignancy

- Conclusion (Seo et al): Considering the favorable survival of pts with thyroid cancer and the potential harm of RAI therapy, physicians need to consider the pros and cons of RAIT when using this treatment option.
- Limitations:
- 1. Risk of malignancy >150 mCi is less than 101-150 mCi.
- 2. Risk of leukemia was slightly less in pts with low (<30 mCi) or moderate (31-100 mCi) RAI than no RAI.
- 3. Follow up is too short – median follow-up – 877 days (2.4 years).

Ref: Seo, et al. Thyroid 2015; 25(8): 927-934

Conclusion – Side Effects – Therapeutic RAI

- Risk of radiation pulmonary fibrosis is dose-related.
- Adverse effect of I-131 on mortality is highly unlikely.
- Small risk of development of leukemia (+/- 0.03%), mainly with higher administered activity.
- **Pregnancy and lactation are absolute contraindications to I-131 therapy**

Overall Conclusions - Risk of SPM in Thyroid Cancer (1)

- Risk of leukemia is probably slightly increased with activities > 1000 mCi. Consider benefits and risks if I-131 burden will exceed 1000 mCi (37 GBq).
- In patients treated with I-131 for thyroid cancer, a slightly increased risk of salivary gland cancer has been seen in some studies.

- **Benefits of I-131 therapy vastly outweigh the risks.**
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Overall Conclusions - Risk of SPM in Thyroid Cancer (2)

- No clear evidence of increased risk of other solid cancer related to I-131 therapy. Increased incidence of other solid tumors in some studies but not others may have a common etiologic or genetic mechanism instead of a causal relationship.
- There is a bi-directional association of breast cancer and DTC. Breast cancer incidence is unrelated to I-131 therapy.

- **Benefits of I-131 therapy vastly outweigh the risks.**

Conclusions I - To Improve Outcomes:

- Understand the uses of nuclear theranostics.
- Incorporation of information from genomics and use of lesional dosimetry will become critically important in the near future.
- Theranostic performance can and should be enhanced.
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Conclusions II - To Improve Outcomes:

- Remnant ablation with I-131 is considered a safe and effective method for eliminating residual normal thyroid tissue, since it facilitates follow-up by improving subsequent detection of residual or recurrent disease.
- **Post therapy scans are critically important for localization and evaluation of regional or distant metastases and planning for subsequent I-131 therapy.**
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References

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- 2. Greenspan BS and Jadvar H. Invited Commentary: Nuclear Theranostics – The Path Forward. Radiographics. 2020; 40:1741-1742
- 3. Donohoe KJ et al. Appropriate Use Criteria for Nuclear Medicine in the Evaluation and Treatment of Differentiated Thyroid Cancer. J Nucl Med 2020; 61(3):375-396
- 4. Avram A, et al. Management of Differentiated Thyroid Cancer: The Standard of Care. J Nucl Med. 2022;63:189-195
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- 7. Maxon, et al. NEJM. 1983; 309:937-941
- 8. Gulec, et al. A Joint Statement from ATA, EANM, ETA, and SNMMI. Thyroid. 2021; 31(7):1009-1019

SAM Questions

- 3. When is the optimal timing to perform post therapy scans?
- A. 1-2 days
- B. 3-7 days
- C. 9-11 days
- D. 13-15 days

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SAM Questions

- 3. When is the optimal timing to perform post therapy scans?
- A. 1-2 days
- **B. 3-7 days (Correct)**
- C. 9-11 days
- D. 13-15 days
- **Explanation**: Using the therapeutic administration of I-131 as an imaging agent, with a physical half-life of 8 days, and a biological half-life of approximately 4-5 days, the maximum utility of the post therapy scan is approximately 3-7 days. 1-2 days is too early, and beyond 7 days is too late.
- References:

- Pacini, et al Eur J Endocrinol 2006;154:787-803
- Silberstein, et al. SNM Practice Guideline JNM 2012; 53(10):1633-1651

SAM Questions

- 4. Which of the following is a known early side effect of I-131 therapy?
- A. Sialadenitis
- B. Bone marrow suppression
- C. Permanent sterility
- D. Radiation-induced carcinogenesis

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SAM Questions

- 4. Which of the following is a known early side effect of I-131 therapy?
- **A. Sialadenitis (Correct)**
- B. Bone marrow suppression
- C. Permanent sterility
- D. Radiation-induced carcinogenesis
- **Explanation**: The correct answer is sialadenitis. Bone marrow suppression would occur somewhat later, and permanent sterility and radiation-induced carcinogenesis are late complications of I-131 therapy.
- Reference:
- Silberstein, et a. SNM Practice Guideline JNM 2012; 53(10):1633-1651