BÖLÜM
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Diferansiye Tiroid Kanseri Radyoaktif İyot Tedavisinde Güncel Yaklaşım

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Özet

Radyoaktif I^{131} (RAI), bilinen ilk teranostik ajan olup yaklaşık 70 yıldır diferansiye tiroid kanseri (DTK)'nin tedavisinde sağ kalımı iyileştirmek, persistan hastalık veya rekürrense bağlı morbidite riskini azaltmak için kullanılmaktadır. Gelişen tanı yöntemleri ve değişen hastalık insidansı nedeniyle DTK tedavi yönetimi gibi radyoaktif iyot tedavisi (RAIT) prensipleri de güncellenmeye devam etmektedir. Dinamik risk belirleme süreci temelindeki güncel yaklaşımda, RAIT'in gerekli hastaya, gereken zamanda ve dozajda uygulanması öne çıkmaktadır. Buna paralel olarak Endokrinoloji ve Nükleer Tıp alanındaki birçok saygın kuruluş düşük riskli hasta grubunda RAIT uygulamasını kısıtlayacak önerilerde bulunmuştur. Ayrıca radyoprotektif bu yaklaşım; kümülatif dozu yüksek olan, yaygın metastatik hastalık nedeniyle yüksek dozaj RAIT endikasyonu olan veya radyasyona maruz kalma açısından hassas olan çocuk hastalarda kantitatif değerlendirme ve dozimetrik çalışmaları da hızlandırmıştır. Mevcut önerilerin hastalık prognozuna ve toplam sağ kalıma etkisini belirlemek için planlanan prospektif randomize klinik çalışmaların bazıları sonuçlanmış, büyük bir kısmı ise devam etmektedir. DTK'nın yavaş seyirli karakteri nedeniyle uzun yıllar takip gerekse de, klinik çalışmaların erken sonuçlarına göre, rekürrens riski yüksek ve/veya metastatik olan hasta grubu dışında RAIT seçici olarak uygulanmalıdır. Bu bölümde Endokrinoloji ve Nükleer Tıp alanındaki güncel kılavuzlar ışığında DTK'da RAIT için hasta seçimi, dozimetri ve tedavi prensipleri özetlenmektedir. Mevcut önerilere ait deneyimler ve veriye dayalı yeni kanıtlar sayesinde bu alanda yeni güncellemeler olması kaçınılmazdır. Bu nedenle, belirtilen prensipler kişiselleştirilmiş hasta takibinde öneri niteliğindedir.

Tedavi Sonrası Takip

RAIT sonrası 3-7 günde yapılan tüm vücut tarama sintigrafisi (TST) tedavi etkinliğini göstermenin yanında bakiye tiroid dokusunu ve metastazları belirlemede duyarlı bir incelemedir. Tanısal TVIT'ye göre daha yüksek dozaj ile yapıldığından daha önce tespit edilemeyen fonksiyonel tiroid dokuları saptanabilir ve teranostik yaklaşım ile RAIT'e yanıt vereceği öngörülebilir. Son yıllarda yaygınlaşan hibrid SPECT/CT gama kameraları sayesinde lezyonların üç boyutlu olarak görüntülenmesi ve anatomik lokalizasyonu da mümkün olmaktadır. RAIT etkinliğini değerlendirmek için serum Tg ve AntiTg düzeyleri, boyun US ve gerekli görülürse 6-8 ay sonra TVIT yapılır. Dinamik risk belirleme sürecinde tüm bu sonuçlara göre; mükemmel yanıt, biyokimyasal yetersiz yanıt, yapısal yetersiz yanıt ve belirsiz yanıt veren hastalara uygun takip protokolü oluşturulur. DTK yavaş ilerleyen ve nispeten yüksek rekürrens oranlı bir malignite olduğundan bu yüzden bu hastalarda ömür boyu takip önerilmektedir. (8,10,19,101).

RAIT sonrası persistan hastalıkta, rekürrens ve metastaz varlığında RAI tutulumu varsa tekrarlayan tedaviler yapılabilir. Genel olarak, yüksek evreli hastalık (evre III ve IV), 45-55 üstü yaş ve agresif histolojik alt tip içeren tümörlerde daha fazla doz gereklidir. RAI direnci gelişmedikçe tam remisyon sağlanana kadar tedaviye devam edilebilir. Maksimum güvenli kümülatif doz konusunda belirgin bir eşik değer belirlemek güçtür. 1Ci 'ye kadar tedaviye devam etmeyi destekleyen araştırmalar olsa >45 yaş hastalarda 600 mCi, <45 yaş hastalarda ise 800 mCi kümülatif doza ulaşan hastalarda RAIT'in riskleri ve hayat kalitesi üzerine etkisi dikkate alınarak diğer tedaviler (cerrahi eksizyon, sistemik kemoterapi, kemoembolizasyon ve moleküler hedef tedavi gibi) açısından vaka bazında değerlendirme yapılmalıdır (51,56,97,102).

Kaynaklar

1. Seidlin SM, Marinelli LD, Oshry E. Radioactive iodine therapy: Effect on Functioning Metastases of Adenocarcinoma of the Thyroid. J Am Med Assoc. 1946;132:838–47.
2. Kabasakal L. Ancestor of Theranostic Approach: Radioactive Iodine "A Prologue to Radionuclide Therapy." Nucl Med Semin. 2015;2:85–91.
3. Silberstein EB. Radioiodine: The classic theranostic agent. Semin Nucl Med. 2012;42(3):164–70.
4. Van Nostrand D. Remnant Ablation, Adjuvant Treatment and Treatment of Locoregional Metastases with 131-I. In: Wartofsky L, Van Nostrand D, editors. Thyroid Cancer A Comprehensive Guide to Clinical Management Third Edition. Third. New York: Springer New York; 2016. p. 395–410.
5. Luster M, Clarke SE, Dietlein M, et al. Guidelines for radioiodine therapy of differentiated thyroid cancer. European Journal of Nuclear Medicine and Molecular Imaging. 2008;35:1941–59.
6. Silberstein EB, Alavi A, Balon HR, et al. The SNMMI practice guideline for therapy of thyroid disease with 131I 3.0. J Nucl Med. 2012;53(10):1633–51.
7. Amin MB, Edge S, Greene F, et al. AJCC Cancer Staging Manual Eighth edition. In: Springer International Publishing. 2017.
8. Haugen BR, Alexander EK, Bible KC, et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid. 2016;26(1):1–133.
9. Wierts R, Brans B, Havekes B, et al. Dose-response relationship in differentiated thyroid cancer patients undergoing radioiodine treatment assessed by means of 124I PET/CT. J Nucl Med. 2016 Jul 1;57(7):1027–32.
10. Türkiye Endokrinoloji ve Metabolizma Derneği. TİROİD HASTALIKLARI TANI VE TEDAVİ KILAVUZU 2019. In Ankara: Türkiye Klinikleri; 2019.
11. Cooper DS, Doherty GM, Haugen BR, et al. Revised American thyroid association management guidelines for patients with thyroid nodules and differentiated thyroid cancer. Thyroid. 2009;19: 1167–214.
12. Haugen BR. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: What is new and what has changed? Cancer. 2017;123: 372–81.
13. Tuttle RM. Differentiated thyroid cancer: Overview of management. UpToDate. 2016:1-17 [cited 2019 Sep 12]. https://www.uptodate.com/contents/differentiated-thyroid-cancer-overview-of-management
14. Vaisman F, Tuttle RM. Clinical Assessment and Risk Stratification in Differentiated Thyroid Cancer. Endocrinol Metab Clin North Am. 2019;48(1):99–108.
15. Ylli D, Van Nostrand D, Wartofsky L. Conventional Radioiodine Therapy for Differentiated Thyroid Cancer. Endocrinol Metab Clin North Am. 2019;48(1):181–97.
16. Padma S, Sundaram PS. Radioiodine as an adjuvant therapy and its role in follow-up of differentiated thyroid cancer. J Cancer Res Ther. 2016;12(3):1109–13.
17. Verburg FA, Hänscheid H, Luster M. Radioactive iodine (RAI) therapy for metastatic differentiated thyroid cancer. Best Pract Res Clin Endocrinol Metab. 2017;31(3):279–90.
18. Schmidbauer B, Menhart K, Hellwig D, Grosse J. Differentiated thyroid cancer—treatment: State of the art. Int J Mol Sci. 2017;18(6):1–17.
19. Verburg FA, Aktolun C, Chiti A, et

al. Why the European Association of Nuclear Medicine has declined to endorse the 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer. Eur J Nucl Med Mol Imaging. 2016;43(6):1001–5.
20. Tuttle MR, Ahuja S, Avram AM, et al. Controversies, Consensus, and Collaboration in the Use of 131 I Therapy in Differentiated Thyroid Cancer: A Joint Statement from the American Thyroid Association, the European Association of Nuclear Medicine, the Society of Nuclear Medicine and Molecular. Thyroid. 2019;29: 461–470 .
21. Moore MD, Postma E, Gray KD, et al. Less is More: The Impact of Multidisciplinary Thyroid Conference on the Treatment of Well-Differentiated Thyroid Carcinoma. World J Surg. 2018;42(2):343–9.
22. Schvartz C, Bonnetain F, Dabakuyo S, et al. Impact on overall survival of radioactive iodine in low-risk differentiated thyroid cancer patients. J Clin Endocrinol Metab. 2012;97(5):1526–35.
23. Carhill AA, Litofsky DR, Ross DS, et al. Long-term outcomes following therapy in differentiated thyroid carcinoma: NTCTCS registry analysis 1987-2012. J Clin Endocrinol Metab. 2015;100(9):3270–9.
24. Schmidt M, Görges R, Drzezga A, Dietlein M. A matter of controversy: Is radioiodine therapy favorable in differentiated thyroid carcinoma? J Nucl Med. 2018;59(8):1195–201.
25. Differentiated Thyroid Cancer: is there a need for radioiodine ablation in low risk patients? (ESTIMABL2) [cited 2019 Sep 8]. https://clinicaltrials.gov/ct2/show/NCT01837745
26. IoN- Is Ablative Radio-iodine Necessary for Low Risk Differentiated Thyroid Cancer Patients (IoN) [cited 2019 Sep 8]. https://clinicaltrials.gov/ct2/show/NCT01398085
27. I-124 PET/CT Based Remnant Radioiodine Ablation Decision Concept in Differentiated Thyroid Cancer (CLERAD-PROBE) [cited 2019 Sep 8]. https://clinicaltrials.gov/ct2/show/NCT01704586
28. Lee JI, Chung YJ, Cho BY, et al. Postoperative-stimulated serum thyroglobulin measured at the time of 131I ablation is useful for the prediction of disease status in patients with differentiated thyroid carcinoma. Surg (United States). 2013;153(6):828–35.
29. Webb RC, Howard RS, Stojadinovic A, et al. The utility of serum thyroglobulin measurement at the time of remnant ablation for predicting disease-free status in patients with differentiated thyroid cancer: A meta-analysis involving 3947 patients. J Clin Endocrinol Metab. 2012;97(8):2754–63.
30. Won GK, Jong HY, Won BK, et al. Change of serum antithyroglobulin antibody levels is useful for prediction of clinical recurrence in thyroglobulin-negative patients with differentiated thyroid carcinoma. J Clin Endocrinol Metab. 2008;93(12):4683–9.
31. Vaisman A, Orlov S, Yip J, et al. Application of post-surgical stimulated thyroglobulin for radioiodine remnant ablation selection in low-risk papillary thyroid carcinoma. Head Neck. 2010;32:689-98.
32. Ibrahimpasic T, Nixon IJ, Palmer FL, et al. Undetectable thyroglobulin after total thyroidectomy in patients with low- and intermediate-risk papillary thyroid cancer - Is there a need for radioactive iodine therapy? Surg (United States). 2012;152(6):1096–105.
33. Robenshtok E, Grewal RK, Fish S, et al. A low postoperative nonstimulated serum thyroglobulin level does not exclude the presence of radioactive iodine avid metastatic foci in intermediate-risk differentiated thyroid cancer patients. Thyroid. 2013;23(4):436–42.
34. Dizdarevic S, Tulchinsky M, McCready V, et al. The World Association of Radiopharmaceutical and Molecular Therapy position statement on the initial radioiodine therapy for differentiated thyroid carcinoma. World J Nucl Med. 2019;18(2):123.
35. Luster M, Aktolun C, Amendoeira I, et al. European perspective on 2015 American thyroid association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: Proceedings of an interactive international symposium. Thyroid. 2019;29(1):7–26.
36. Avram AM, Fig LM, Frey KA, et al. Preablation 131-I scans with SPECT/CT in postoperative thyroid cancer patients: what is the impact on staging? J Clin Endocrinol Metab. 2013;98(3):1163–71.
37. Sherman SI, Tielens ET, Sostre S, et al.Clinical utility of posttreatment radioiodine scans in the management of patients with thyroid carcinoma. J Clin Endocrinol Metab. 1994;78(3):629–34.
38. Samaan NA, Schultz PN, Hickey RC, et al. The results of various modalities of treatment of well differentiated thyroid carcinomas: A retrospective review of 1599 patients. J Clin Endocrinol Metab. 1992;75(3):714–20.
39. Jentzen W, Verschure F, Van Zon A, et al. 124I PET assessment of response of bone metastases to initial radioiodine treatment of differentiated thyroid cancer. J Nucl Med. 2016 Oct 1;57(10):1499–504.
40. Sheikh A, Polack B, Rodriguez Y, Kuker R. Nuclear Molecular and Theranostic Imaging for Differentiated Thyroid Cancer. Mol Imaging Radionucl Ther. 2017;26(1(1)):50–65.
41. Khorjekar GR, Van Nostrand D, Garcia C, et al. Do negative 124I pretherapy positron emission tomography scans in patients with elevated serum thyroglobulin levels predict negative 131I posttherapy scans? Thyroid. 2014;24(9):1394–9.
42. Salvatori M, Cremonesi M, Indovina L, et al. Radiobiology and radiation dosimetry in nuclear medicine. In: Strauss HW, Mariani G, Volterrani D, Larson SM, editors. Nuclear Oncology: From Pathophysiology to Clinical Applications. Cham: Springer International Publishing; 2017: 1–45.
43. Mallick U, Harmer C, Yap B, et al. Ablation with low-dose radioiodine and thyrotropin alfa in thyroid cancer. N Engl J Med 2012; 366:1674-85.
44. Schlumberger M, Catargi B, Borget I, et al. Strategies of radioiodine ablation in patients with low-risk thyroid cancer. N Engl J Med. 2012;366(18):1663–73.
45. Verburg FA, Mäder U, Reiners C, Hänscheid H. Long-term survival in differentiated thyroid cancer is worse after low-activity initial post-surgical131I therapy in both high- And low-risk patients. J Clin Endocrinol Metab. 2014;99:4487–96.
46. Kukulska A, Krajewska J, Gawkowska-Suwińska M, et al. Radioiodine thyroid remnant ablation in patients with differentiated thyroid carcinoma (DTC): prospective comparison of long-term outcomes of treatment with 30, 60 and 100 mCi. Thyroid Res 2010;3(1):9.
47. Fallahi B, Beiki D, Takavar A, et al. Low versus high radioiodine dose

in postoperative ablation of residual thyroid tissue in patients with differentiated thyroid carcinoma: A large randomized clinical trial. Nucl Med Commun. 2012;33:275–82.
48. Goldsmith SJ. Radioactive Iodine Therapy of Differentiated Thyroid Carcinoma: Redesigning the Paradigm. Mol Imaging Radionucl Ther. 2017 Feb 1;26(1(1)):74–9.
49. Tumino D, Frasca F, Newbold K. Updates on the management of advanced, metastatic, and radioiodine refractory differentiated thyroid cancer. Front Endocrinol (Lausanne). 2017;8:1–7.
50. Nixon IJ, Simo R, Newbold K, et al. Management of Invasive Differentiated Thyroid Cancer. Thyroid. 2016;26(9):1156–66.
51. Durante C, Haddy N, Baudin E, et al. Long-term outcome of 444 patients with distant metastases from papillary and follicular thyroid carcinoma: Benefits and limits of radioiodine therapy. J Clin Endocrinol Metab. 2006;91(8):2892–9.
52. Zhang X, Liu DS, Luan ZS, et al. Efficacy of radioiodine therapy for treating 20 patients with pulmonary metastases from differentiated thyroid cancer and a meta-analysis of the current literature. Clin Transl Oncol. 2018 Jul 1;20(7):928–35.
53. Wang R, Zhang Y, Tan J, et al. Analysis of radioiodine therapy and prognostic factors of differentiated thyroid cancer patients with pulmonary metastasis. Medicine (Baltimore). 2017;96(19):1–6.
54. Kushchayeva YS, Kushchayev S V., Wexler JA, et al. Current treatment modalities for spinal metastases secondary to thyroid carcinoma. Thyroid. 2014;24(10):1443–55.
55. Gomes-Lima CJ, Wu D, Rao SN, et al. Brain Metastases From Differentiated Thyroid Carcinoma: Prevalence, Current Therapies, and Outcomes. J Endocr Soc. 2019;3(2):359–71.
56. Martins-Filho R, Ward LS, Amorim BJ, et al. Cumulative doses of radioiodine in the treatment of differentiated thyroid carcinoma: knowing when to stop. Arq Bras Endocrinol Metabol. 2010;54(9):807–12.
57. Mihailovic J, Stefanovic L, Malesevic M, Markoski B. The importance of age over radioiodine avidity as a prognostic factor in differentiated thyroid carcinoma with distant metastases. Thyroid. 2009;19(3):227–32.
58. Demir M, Yeyin N. Teranostiklerle Tedavide Dozimetrik Yaklaşım: I-131 Tedavilerinde Dozimetri. Turkiye Klin Nucl Med - Spec Top. 2018;4(3):11–5.
59. Benua RS, Cicale NR, Sonenberg M, Rawson RW. The relation of radioiodine dosimetry to results and complications in the treatment of metastatic thyroid cancer. Am J Roentgenol Radium Ther Nucl Med. 1962;87:171–82.
60. Klubo-Gwiezdzinska J, Van Nostrand D, Atkins F, et al. Efficacy of dosimetric versus empiric prescribed activity of 131I for therapy of differentiated thyroid cancer. J Clin Endocrinol Metab. 2011;96(10):3217–25.
61. Deandreis D, Rubino C, Tala H, et al. Comparison of empiric versus whole-body/-blood clearance dosimetry-based approach to radioactive iodine treatment in patients with metastases from differentiated thyroid cancer. J Nucl Med. 2017;58(5):717–22.
62. Maxon HR, Englaro EE, Thomas SR, et al. Radioiodine-131 therapy for well-differentiated thyroid cancer - A quantitative radiation dosimetric approach: Outcome and validation in 85 patients. J Nucl Med. 1992;33(6):1132–6.
63. Hobbs RF, Mcnutt T, Baechler S, et al. A treatment planning methodology for sequentially combining radiopharmaceutical therapy (RPT) and external radiation therapy (XRT). Int J Radiat Oncol Biol Phys. 2012;80(4):1256–62.
64. Sun F, Gerrard GE, Roberts JK, et al. Ten Year Experience of Radioiodine Dosimetry: is it Useful in the Management of Metastatic Differentiated Thyroid Cancer? Clin Oncol. 2017;29(5):310–5.
65. Luster M, Pfestroff A, Hänscheid H, Verburg FA. Radioiodine Therapy. Semin Nucl Med 2017;47(2):126–34.
66. Edmonds CJ, Hayes S, Kermode JC, Thompson BD. Measurement of serum TSH and thyroid hormones in the management of treatment of thyroid carcinoma with radioiodine. Br J Radiol. 1977;50(599):799–807.
67. Kogai T, Endo T, Saito T, et al. Regulation by thyroid-stimulating hormone of sodium/iodide symporter gene expression and protein levels in FRTL-5 cells. Endocrinology. 1997;138(6):2227–32.
68. Zhao T, Liang J, Guo Z, et al. Serum thyrotropin level of 30 μIU/mL is inadequate for preablative thyroglobulin to serve as a prognostic marker for differentiated thyroid cancer. Endocrine. 2016;53(1):166–73.
69. McDougall IR, Weigel RJ. Recombinant human thyrotropin in the management of thyroid cancer. Curr Opin Oncol. 2001;13:39–43.
70. Karam M, Gianoukakis A, Feustel PJ, et al. Influence of diagnostic and therapeutic doses on thyroid remnant ablation rates. Nucl Med Commun. 2003;24(5):489–95.
71. Prpic M, Dabelic N, Stanicic J, et al. Adjuvant thyroid remnant ablation in patients with differentiated thyroid carcinoma confined to the thyroid: a comparison of ablation success with different activities of radioiodine (I-131). Ann Nucl Med. 2012;26(9):744–51.
72. Luster M, Felbinger R, Dietlein M, Reiners C. Thyroid hormone withdrawal in patients with differentiated thyroid carcinoma: a one hundred thirty-patient pilot survey on consequences of hypothyroidism and a pharmacoeconomic comparison to recombinant thyrotropin administration. Thyroid. 2005;15(10):1147–55.
73. Mazzaferri EL, Kloos RT. Using recombinant human TSH in the management of well-differentiated thyroid cancer: current strategies and future directions. Thyroid. 2000;10(9):767–78.
74. Meier CA, Braverman LE, Ebner SA, et al. Diagnostic use of recombinant human thyrotropin in patients with thyroid carcinoma (phase I/II study). J Clin Endocrinol Metab. 1994;78(1):188–96.
75. Ladenson PW, Braverman LE, Mazzaferri EL, et al. Comparison of administration of recombinant human thyrotropin with withdrawal of thyroid hormone for radioactive iodine scanning in patients with thyroid carcinoma. N Engl J Med. 1997;337(13):888–96.
76. Haugen BR, Pacini F, Reiners C, et al. A comparison of recombinant human thyrotropin and thyroid hormone withdrawal for the detection of thyroid remnant or cancer. J Clin Endocrinol Metab. 1999;84(11):3877–85.
77. Schlumberger M, Ricard M, Pacini F. Clinical use of recombinant human TSH in thyroid cancer patients. Eur J Endocrinol. 2000;143(5):557–63.
78. Pacini F, Molinaro E, Castagna MG, et al. Ablation of thyroid residues with 30 mCi (131)I: a comparison in thyroid cancer patients

prepared with recombinant human TSH or thyroid hormone withdrawal. J Clin Endocrinol Metab. 2002;87(9):4063–8.
79. Barbaro D, Boni G, Meucci G, et al. Radioiodine treatment with 30 mCi after recombinant human thyrotropin stimulation in thyroid cancer: Effectiveness for postsurgical remnants ablation and possible role of iodine content in L-thyroxine in the outcome of ablation. J Clin Endocrinol Metab. 2003 Sep 1;88(9):4110–5.
80. Luster M, Lippi F, Jarzab B, et al. rhTSH-aided radioiodine ablation and treatment of differentiated thyroid carcinoma: A comprehensive review. Endocr Relat Cancer. 2005;12(1):49–64.
81. Schlumberger M, Leboulleux S, Catargi B, et al. Outcome after ablation in patients with low-risk thyroid cancer (ESTIMABL1): 5-year follow-up results of a randomised, phase 3, equivalence trial. lancet Diabetes Endocrinol. 2018;6(8):618–26.
82. Klubo-Gwiezdzinska J, Burman KD, Van Nostrand D, et al. Radioiodine treatment of metastatic thyroid cancer: relative efficacy and side effect profile of preparation by thyroid hormone withdrawal versus recombinant human thyrotropin. Thyroid. 2012;22(3):310–7.
83. Bartenstein P, Calabuig EC, Maini CL, et al. High-risk patients with differentiated thyroid cancer T4 primary tumors achieve remnant ablation equally well using rhTSH or thyroid hormone withdrawal. Thyroid. 2014;24(3):480–7.
84. Vallejo Casas JA, Mena Bares LM, et al. Thyroid remnant ablation success and disease outcome in stage III or IV differentiated thyroid carcinoma: recombinant human thyrotropin versus thyroid hormone withdrawal. Q J Nucl Med Mol Imaging. 2016;60(2):163–71.
85. Giovanella L, Duntas LH. Management Of Endocrıne Disease: The Role of rhTSH in the Management of Differentiated Thyroid Cancer: Pros and Cons. Eur J Endocrinol. 2019;181(4):133–45.
86. Kang SW, Yap ZZ, Lee CR, et al. Pattern of urine iodine excretion with low iodine diet during preparation for radioactive iodine ablation in patients with thyroid cancer. Head Neck. 2019 Feb 1;41(2):381–7.
87. Rasmussen LB, Ovesen L, Christiansen E. Day-to-day and within-day variation in urinary iodine excretion. Eur J Clin Nutr. 1999;53(5):401–7.
88. Kim HK, Lee SY, Lee JI, et al. Usefulness of iodine/creatinine ratio from spot-urine samples to evaluate the effectiveness of low-iodine diet preparation for radioiodine therapy. Clin Endocrinol (Oxf). 2010;73(1):114–8.
89. Lee M, Lee YK, Jeon TJ, et al. Low iodine diet for one week is sufficient for adequate preparation of high dose radioactive iodine ablation therapy of differentiated thyroid cancer patients in iodine-rich areas. Thyroid. 2014;24(8):1289–96.
90. Li JH, He ZH, Bansal V, Hennessey J V. Low iodine diet in differentiated thyroid cancer: A review. Clinical Endocrinology. 2016; 84: 3–12.
91. Sawka AM, Brierley JD, Tsang RW, et al. An Updated Systematic Review and Commentary Examining the Effectiveness of Radioactive Iodine Remnant Ablation in Well-Differentiated Thyroid Cancer. Endocrinology and Metabolism Clinics of North America. 2008; 37(2):457-80.
92. Kim M, Han M, Jeon MJ, et al. Impact of delayed radioiodine therapy in intermediate-/high-risk papillary thyroid carcinoma. Clin Endocrinol. 2019;91(3):449–55.
93. Oh J-R, Ahn B-C. False-positive uptake on radioiodine whole-body scintigraphy: physiologic and pathologic variants unrelated to thyroid cancer. Am J Nucl Med Mol Imaging. 2012;2(3):362–85.
94. Suman P, Wang C-H, Moo-Young TA, et al. Timing of Adjuvant Radioactive Iodine Therapy Does Not Affect Overall Survival in Low- and Intermediate-Risk Papillary Thyroid Carcinoma. Am Surg. 2016;82(9):807–14.
95. Li H, Zhang YQ, Wang C, et al. Delayed initial radioiodine therapy related to incomplete response in low- to intermediate-risk differentiated thyroid cancer. Clin Endocrinol. 2018 Apr 1;88(4):601–6.
96. Schechter RB, Nagilla M, Joseph L, et al. Genetic profiling of advanced radioactive iodine-resistant differentiated thyroid cancer and correlation with axitinib efficacy. Cancer Lett. 2015;359(2):269–74.
97. Clement SC, Peeters RP, Ronckers CM, et al. Intermediate and long-term adverse effects of radioiodine therapy for differentiated thyroid carcinoma - A systematic review. Cancer Treat Rev. 2015;41(10):925–34.
98. Ceccarelli C, Bencivelli W, Morciano D, et al. 131I therapy for differentiated thyroid cancer leads to an earlier onset of menopause: Results of a retrospective study. J Clin Endocrinol Metab. 2001;86(8):3512–5.
99. Evranos B, Faki S, Polat SB, et al. Effects of Radioactive Iodine Therapy on Ovarian Reserve: A Prospective Pilot Study. Thyroid. 2018 Dec 1;28(12):1702–7.
100. Hirsch D, Shohat T, Gorshtein A, et al. Incidence of Nonthyroidal Primary Malignancy and the Association with 131I Treatment in Patients with Differentiated Thyroid Cancer. Thyroid. 2016 Aug 1;26(8):1110–6.
101. Ak Sivriöz İ. Güncel Kılavuzlar Işığında Diferansiye Tiroid Kanserlerinde Radyoaktif İyot Tedavisi. Türkiye Klin. 2018;4(3):22–31.
102. Yang J, Zheng R, Liang M, et al. Association of the cumulative dose of radioactive iodine therapy with overall survival in patients with differentiated thyroid cancer and pulmonary metastases. Front Oncol. 2019;9:1–9.