

BÖLÜM

7

Tiroid Nodüllerinde Tanısal Yaklaşım: Radyonüklid Görüntüleme

- Uzm. Dr. Zuhal KANDEMİR
- Doç. Dr. Elif ÖZDEMİR

Özet

Tiroid sintigrafisi, tiroid bezi hastalıklarında geçmişten günümüze kadar, en sık kullanılan radyonüklid görüntüleme tekniği olup; tiroid nodüllerinde fonksiyonel değerlendirmenin ayrılmaz bir parçasıdır. Uzun yillardır tiroid sintigrafisi ve tiroid uptake ölçüm çalışmalarında, tiroidin iyodu konsantr etme özelliğinden dolayı I^{123} ve I^{131} gibi radyonüklidler kullanılmaktadır. Tc^{99m} perteknetat iyot ile benzer tutulum mekanizmasına sahip olması ve gama kameralarda görüntüleme için ideal fiziksel özellikleri ile tiroid sintigrafisinde rutin kullanımına uygun bir ajandır. Yaygın olmamakla birlikte tiroid uptake çalışmalarında da kullanılmaktadır.

Tiroid sintigrafisi, tiroid nodüllerinin değerlendirilmesinde başlangıç tetkiki olarak tercih edilmese de hipertiroidi belirtileri veya semptomları veya baskılanmış TSH ile seçilen hastaların tanısında,超声波圖像和 diğer görüntüleme yöntemlerine tamamlayıcı olan bir tanısal yöntemdir.

Fizik muayene ya da görüntüleme yöntemleri ile tespit edilen nodüllerin benign/malign ayrimının yapılması klinikte karşılaşılan önemli bir sorundur. Bu grup hastalara öncelikli yaklaşım, var olan malignite riskini dışlanması ve düşük riskli nodüllerin gereksiz cerrahisinin önlenmesidir. Sitolojik olarak belirsiz (indeterminate) tiroid nodüllerinin ayırıcı tanısında, Tc^{99m} MIBI, Talyum 201 , F^{18} -FDG gibi radyonüklidlerin kullanıldığı birçok çalışma mevcuttur. Literatürde bu radyonüklidlerin malign nodüllerin belirlenmesine katkısı olduğu bildirilmekle birlikte; daha spesifik moleküller ajanlara ihtiyaç duyulmaktadır.

Kaynaklar

1. Treves ST, Fahey FH. Dose Optimization in Pediatric Nuclear Medicine. In: Pediatric Nuclear Medicine and Molecular Imaging. New York: Springer; 2014:683–694.
2. Evren Atlıhan Gündoğdu, Emre Özgenç, Meliha Ekinci, Derya İlem Özdemir, Makbule Aşikoğlu. Nükleer Tıpta Görüntülemede ve Tedavide Kullanılan Radifarmasötikler J Lit Pharm Sci 2018;7(1):24-34
3. Hamburger JI. Diagnosis of thyroid nodules by fine needle biopsy: use and abuse. *J Clin Endocrinol Metab* 1994;79:335-9.
4. Noyek AM, Finkelstein DM, Witterick IJ, Kirsh JC. Diagnostic Imaging of the Thyroid Gland. In: Falk SE. Thyroid Disease. Second Edition. Philadelphia: Lippincott Raven, 1997: 135-43.
5. Sawin CT, Becker DV. Radioiodine and the treatment of hyperthyroidism: the early history. *Thyroid*. 1997;7(2):163-76
6. Töre G, Özkalıcı H, Kir M, Yüksel D. TNTD, Tiroit Sintigrafisi Uygulama Kılavuzu 2.0 Nükleer Tip Seminerleri. *Nucl Med Semin* 2015;1(1):41-43
7. Cooper DS, Doherty GM, Haugen BR, Kloos RT, Lee SL, Mandel SJ, Mazzaferri EL, McIver B, Pacini F, Schlumberger M, Sherman SI, Steward DL, Tuttle RM. Revised American thyroid association management guidelines for patients with thyroid nodules and differentiated thyroid cancer. *Thyroid*. 2009;19:1167–214.
8. Pacini F, Schlumberger M, Dralle H, Elisei R, Smit JWA, Wiersinga W, the European Thyroid Cancer Taskforce. European consensus for the management of patients with differentiated thyroid carcinoma of the follicular epithelium. *Eur J Endocrinol*. 2006;154: 787–803.
9. Gharib H, Papini E, Paschke R, Duick DS, Valcavi R, Hegedus L, Vitti P. American Association of Clinical Endocrinologists, Associazione Medici Endocrinologi, and European Thyroid Association medical guidelines for clinical practice for the diagnosis and management of thyroid nodules. *Endocrine Practice* 2010;16(1):1-43.
10. Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, 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.
11. Pandey AK, Sharma SK, Sharma P, Gupta P, Kumar R. Development of a radiopharmaceutical dose calculator for pediatric patients undergoing diagnostic nuclear medicine studies. *Indian J Nucl Med*. 2013; 28(2):75-8.
12. Adalet I, Mudun A, Ünal SN, Türkmen C. Nükleer Tip Görüntüleme Yöntemlerinde Temel İlkeler. Nükleer Tip Ders Kitabı. İstanbul Üniversitesi Yayınları; 2012;1-13
13. Balon HR, Silberstein EB, Meier DA, Charkes ND, Sarkar SD, Royal HD, Donohoe KJ. Society of Nuclear Medicine Procedure Guideline for Thyroid Scintigraphy V3.0.
14. Adalet I, Mudun A, Ünal SN, Türkmen C. Endokrin Sistemde Nükleer Tip Uygulamaları; Nükleer Tip Ders Kitabı. İstanbul Üniversitesi Yayınları; 2012;13-37
15. Cooper DS, Doherty GM, Haugen BR, et al. Management guidelines for patients with thyroid nodules and differentiated thyroid cancer. *Thyroid* 2006;16:109-42.
16. Schneider MT, Glister O, Hall JP, Acio E, Kulkarni KP, Tran AT, Van Nostrand D. Thyroid cancer in functioning thyroid nodules. Presented at the 2012 ACNM Mid-Winter meeting.
17. Mirfakhraee S, Mathews D, Peng L, Woodruff S, Zigman JM. A solitary hyperfunctioning thyroid nodule harboring thyroid carcinoma: review of the literature. *Thyroid Res*. 2013;6(1):7.
18. Tonacchera M, Pinchera A, Vitti P. Assessment of nodular goitre. *Best Pract Res Clin Endocrinol Metab*. 2010;24(1):51–61.
19. Ashcraft MW, Van Herle AJ. Management of thyroid nodules II: scanning techniques tyroid suppressive and fine needle aspiration. *Head Neck Surg* 1981; 3: 297-322.
20. Belfiore A, La Rosa GL, La Porta GA, Giuffrida D, Milazzo G, Lupo L, et al. Cancer risk in patients with cold thyroid nodules: relevance of iodine intake, sex, age, and multinodularity. *Am J Med*. 1992;93(4):363–9.
21. Kraimps JL, Bouin-Pineau MH, Mathonnet M, De Calan L, Ronceray J, Visset J, et al. Multicentre study of thyroid nodules in patients with Graves' disease. *Br J Surg*. 2000;87(8):1111–3.
22. Sandler MP, Coleman RE, Patton JA, et al. Diagnostic nuclear medicine. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2003
23. Kusic Z, Becker DV, Saenger EL, et al. Comparison of technetium99m and iodine-123 imaging of thyroid nodules: correlation with pathologic findings. *J Nucl Med*. 1990;31:393–9.
24. Ryo UY, Vaidya PV, Schneider AB, et al. Thyroid imaging agents: a comparison of I-123 and Tc-99m pertechnetate. *Radiology*. 1983;148:819–22.
25. Reschini E, Ferrari C, Castellani M, Matheoud R, Paracchi A, Marotta G, et al. The trapping only nodules of the thyroid gland: prevalence study. *Thyroid*. 2006;16(8):757–62.
26. Comprehensive Cancer Network (NCCN). Clinical practice guidelines in oncology. Thyroid carcinoma. Follicular Thyroid Carcinoma. V.1.2010.
27. O'Doherty M.J., Coakley T.J. Parathyroid imaging. In: Ell P.J, Gambhir S.S eds: Nuclear Medicine in Clinical Diagnosis and Treatment, Third edition, volume I part 4. 2004, p. 35-44
28. Yamamoto Y, Okumura Y, Sato S, Maki K, Mukai T, Mifune H, Akasaki S, Takeda Y, Kanazawa S, Hiraki Y. Differentiation of thyroid nodules using Tl-201 scintigraphy quantitative analysis and fine-needle aspiration biopsy. *Acta Med Okayama* 2004; 58(2):75-83.
29. Sharma R, Mondal A, Shankar LR, Sahoo M, Bhatnagar P, Sawroop K, Chopra MK, Kashyap R: Differentiation of malignant and benign solitary thyroid nodules using 30- and 120-minute Tc-99m MIBI scans. *Clin Nucl Med* 2004; 29(9):534-537.

30. Treglia G, Caldarella C, Saggiorato E, Ceriani L, Orlandi F, Salvatori M, et al. Diagnostic performance of (99m)Tc-MIBI scan in predicting the malignancy of thyroid nodules: a meta-analysis. *Endocrine*. 2013;44:70–8.
31. Saggiorato E, Angusti T, Rosas R, Martinese M, Finessi M, Arecco F, et al. 99mTc-MIBI imaging in the presurgical characterization of thyroid follicular neoplasms: relationship to multidrug resistance protein expression. *J Nucl Med*. 2009;50 (11):1785–93.
32. Giovannella L, Campenni A, Treglia G, Verburg FA, Trimboli P, Ceriani L, et al. Molecular imaging with (99m)Tc-MIBI and molecular testing for mutations in differentiating benign from malignant follicular neoplasm: a prospective comparison. *Eur J Nucl Med Mol Imaging*. 2016;43(6):1018–26.
33. Campenni A, Giovannella L, Siracusano M, Alibrandi A, Pignata SA, Giovinazzo S, et al. (99m) Tc-Methoxy-isobutyl-isonitrile scintigraphy is a useful tool for assessing the risk of malignancy in thyroid nodules with indeterminate fine-needle cytology. *Thyroid*. 2016;26(8):1101–9.
34. Sager S, Vatankulu B, Erdogan E, Mut S, Teksoz S, Ozturk T, et al. Comparison of F-18 FDGPET/CT and Tc-99m MIBI in the preoperative evaluation of cold thyroid nodules in the same patient group. *Endocrine*. 2015;50(1):138–45.
35. Czepczyński R. Nuclear medicine in the diagnosis of benign thyroid diseases. *Nucl Med Rev Cent East Eur*. 2012; 15: 113–119
36. Cem Gökhan Şışman , Erhan Varoğlu , Bedri Seven , Ali Şahin , Ali Şener Karagölge , Hakan Dursun. Teknesyum 99m Perteknetat ile Tiroid Uptake ve Ağırlık Hesaplaması. *The Eurasian Journal of Medicine* 2007;39
37. Chen YK, Ding HJ, Chen KT, Chen YL, Liao AC, Shen YY, Su CT, Kao CH. Prevalence and risk of cancer of focal thyroid incidentaloma identified by 18F-fluorodeoxyglucose positron emission tomography for cancer screening in healthy subjects. *Anticancer Res* 2005;25:1421–1426.
38. Cohen MS, Arslan N, Dehdashti F, Doherty GM, Lairmore TC, Brunt LM, Moley JF. Risk of malignancy in thyroid incidentalomas identified by fluorodeoxyglucose positron emission tomography. *Surgery* 2001;130:941–946.
39. Kang KW, Kim SK, Kang HS, Lee ES, Sim JS, Lee IG, Jeong SY, Kim SW. Prevalence and risk of cancer of focal thyroid incidentaloma identified by 18F-fluorodeoxyglucose positron emission tomography for metastasis evaluation and cancer screening in healthy subjects. *J Clin Endocrinol Metab* 2003;88:4100–4104.
40. Kim TY, Kim WB, Ryu JS, Gong G, Hong SJ, Shong YK. 18F-fluorodeoxyglucose uptake in thyroid from positron emission tomogram (PET) for evaluation in cancer patients: high prevalence of malignancy in thyroid PET incidentaloma. *Laryngoscope* 2005;115:1074–1078.
41. Hsieh HJ, Liu RS, Liao SQ, Chu YK, Chu LS, Chang CP. The clinical relevance of thyroid incidentalomas detected by F-18-fluorodeoxyglucose positron emission tomography. *J Nucl Med* 2003; 44:397–398.
42. Chen W, Parsons M, Torigian DA, Zhuang H, Alavi A Evaluation of thyroid FDG uptake incidentally identified on FDG-PET/ CT imaging. *Nucl Med Commun* 2009;30:240–244.
43. Leonard Wartofsky and Douglas Van Nostrand Thyroid Cancer: A Comprehensive Guide to Clinical Management. Third edition. Springer 2016. p 487–504. ISBN 978-1-4939-3312-9
44. Treglia G, Bertagna F, Sadeghi R, Verburg FA, Ceriania L, Giovannella L. Focal thyroid incidental uptake detected by 18F-fluorodeoxyglucose positron emission tomography: meta-analysis on prevalence and malignancy risk. *Nuklearmedizin* 2013;52:130–136.
45. Shie P, Cardarelli R, Sprawls K, Fulda KG, Taur A. Systematic review: prevalence of malignant incidental thyroid nodules identified on fluorine-18 fluorodeoxyglucose positron emission tomography. *Nucl Med Commun* 2009; 30:742–748
46. Soelberg KK, Bonnema SJ, Brix TH, Hegedüs L. Risk of malignancy in thyroid incidentalomas detected by 18F-fluorodeoxyglucose positron emission tomography: a systematic review. *Thyroid*. 2012 Sep;22(9):918–25.
47. Filetti S, Damante G, Foti D. Thyrotropin stimulates glucose transport in cultured rat thyroid cells. *Endocrinology* 1987;120:2576–2581.
48. Ali S, Cibas E. The Bethesda System for Reporting Thyroid Cytopathology: Definitions, Criteria, and Explanatory Notes. Second edition. Springer, New York, NY. 2010. P. 1–5.
49. Wang N, Zhai H, Lu Y. Is fluorine-18 fluorodeoxyglucose positron emission tomography useful for the thyroid nodules with indeterminate fine needle aspiration biopsy? A meta-analysis of the literature. *J Otolaryngol Head Neck Surg*. 2013;1;42:38.
50. Vriens D, de Wilt JH, van der Wilt GJ, Netea-Maier RT, Oyen WJ, de Geus-Oei LF. The role of [18F]-2-fluoro-2-deoxy-d-glucose-positron emission tomography in thyroid nodules with indeterminate fine-needle aspiration biopsy: systematic review and meta-analysis of the literature. *Cancer*. 2011;15;117(20):4582–94.
51. Castellana M, Trimboli P, Piccardo A, Giovannella L, Treglia G. Performance of (18)F-FDG PET/CT in Selecting Thyroid Nodules with Indeterminate Fine-Needle Aspiration Cytology for Surgery. A Systematic Review and a Meta-Analysis. *J Clin Med*. 2019;28(8)(9).
52. Vriens D, Adang EM, Netea-Maier RT, Smit JW, de Wilt JH, Oyen WJ, de Geus-Oei LF. Cost-effectiveness of FDG-PET/CT for cytologically indeterminate thyroid nodules: a decision analytic approach. *J Clin Endocrinol Metab*. 2014;99(9):3263–74.