



Universiteit
Leiden
The Netherlands

Management of indeterminate thyroid nodules: changing the paradigm

Koster, E.J. de

Citation

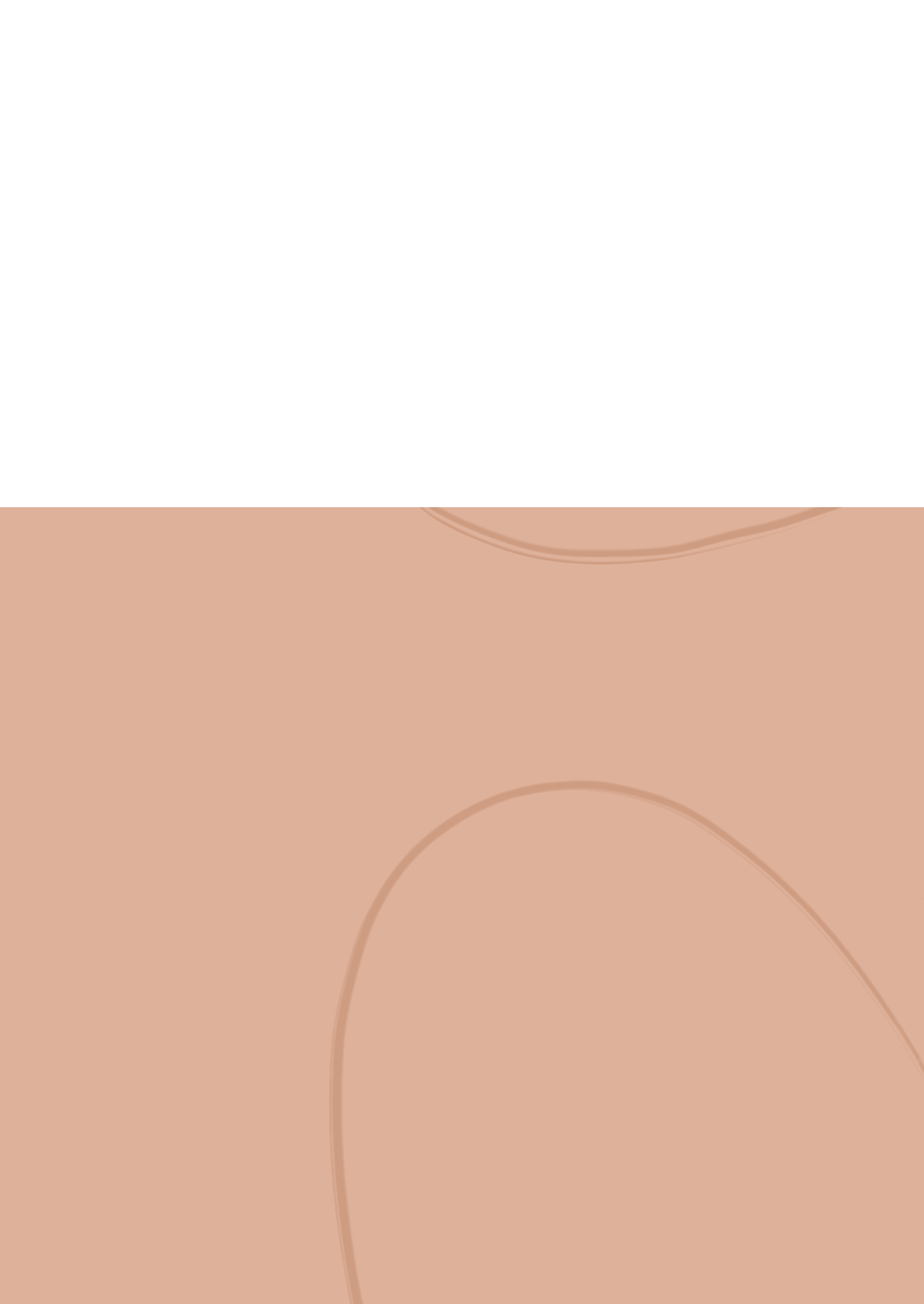
Koster, E. J. de. (2025, March 6). *Management of indeterminate thyroid nodules: changing the paradigm*. Retrieved from <https://hdl.handle.net/1887/4196714>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/4196714>

Note: To cite this publication please use the final published version (if applicable).



Glossary

The background of the page is a solid orange color. On the left side, there are several thin, white, curved lines that sweep across the page. A prominent feature is a large, stylized white letter 'e' that is partially enclosed by one of these lines.

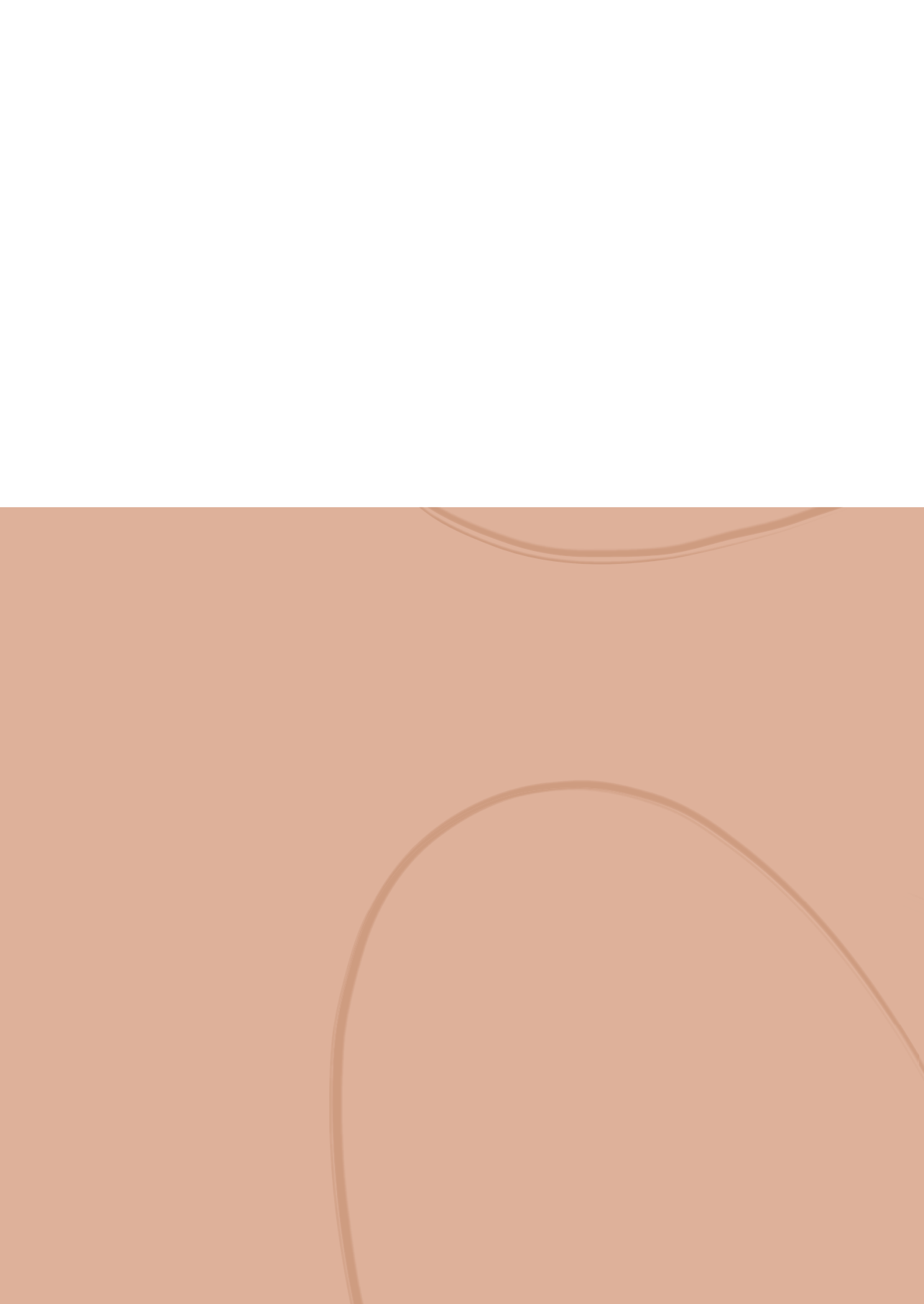
Glossary

[¹⁸ F]FDG	[¹⁸ F]-2-fluoro-2-deoxy-D-glucose, fluorodeoxyglucose
[¹⁸ F]FDG-PET	[¹⁸ F]-2-fluoro-2-deoxy-D-glucose positron emission tomography
[^{99m} Tc]Tc-MIBI	hexakis(2-methoxy-2-methylpropylisocyanide)technetium[^{99m} Tc]
¹³¹ I	radioiodine
^{99m} Tc	technetium-99m
^{99m} TcO ₄ ⁻	^{99m} Tc-pertechnetate
ACR	American College of Radiology
ADC	apparent diffusion coefficient
AI	artificial intelligence
ATA	American Thyroid Association
AUC	area under the curve
AUS	atypia of undetermined significance
AUS/FLUS	AUS or follicular lesion of undetermined significance
B-mode	bright mode
BCR	benign call rate
BRAF	B-type RAF kinase
BTA	British Thyroid Association
(c)TT	completing total thyroidectomy
CA	carcinoma
CA-IX	carbonic anhydrase IX
CEAC	cost-effectiveness acceptability curve
CI	confidence interval
CK-19	cytokeratin 19
CNA	copy number alterations
CNA-LOH	CNA and loss of heterozygosity
CNN	convolutional neural networks
CT	computed tomography
Df	degrees of freedom
DLR	diagnostic likelihood ratio
DPO-PCR	dual priming oligonucleotide PCR
DTC	differentiated thyroid carcinoma
DW-MRI	diffusion-weighted magnetic resonance imaging
e.g.	exempli gratia, for example
EANM	European Association of Nuclear Medicine
EfFECTS	Efficacy of [¹⁸ F]FDG-PET in Evaluation of Cytological indeterminate Thyroid nodules prior to Surgery
EQ-5D-5L	EuroQol 5-dimension 5-level
eFVPTC	(encapsulated) follicular variant of papillary thyroid carcinoma
FA	follicular adenoma
FA-OV	oncocytic variant of follicular adenoma, currently known as OA
[¹⁸ F]FDG-PET/CT	[¹⁸ F]FDG positron emission tomography / computed tomography

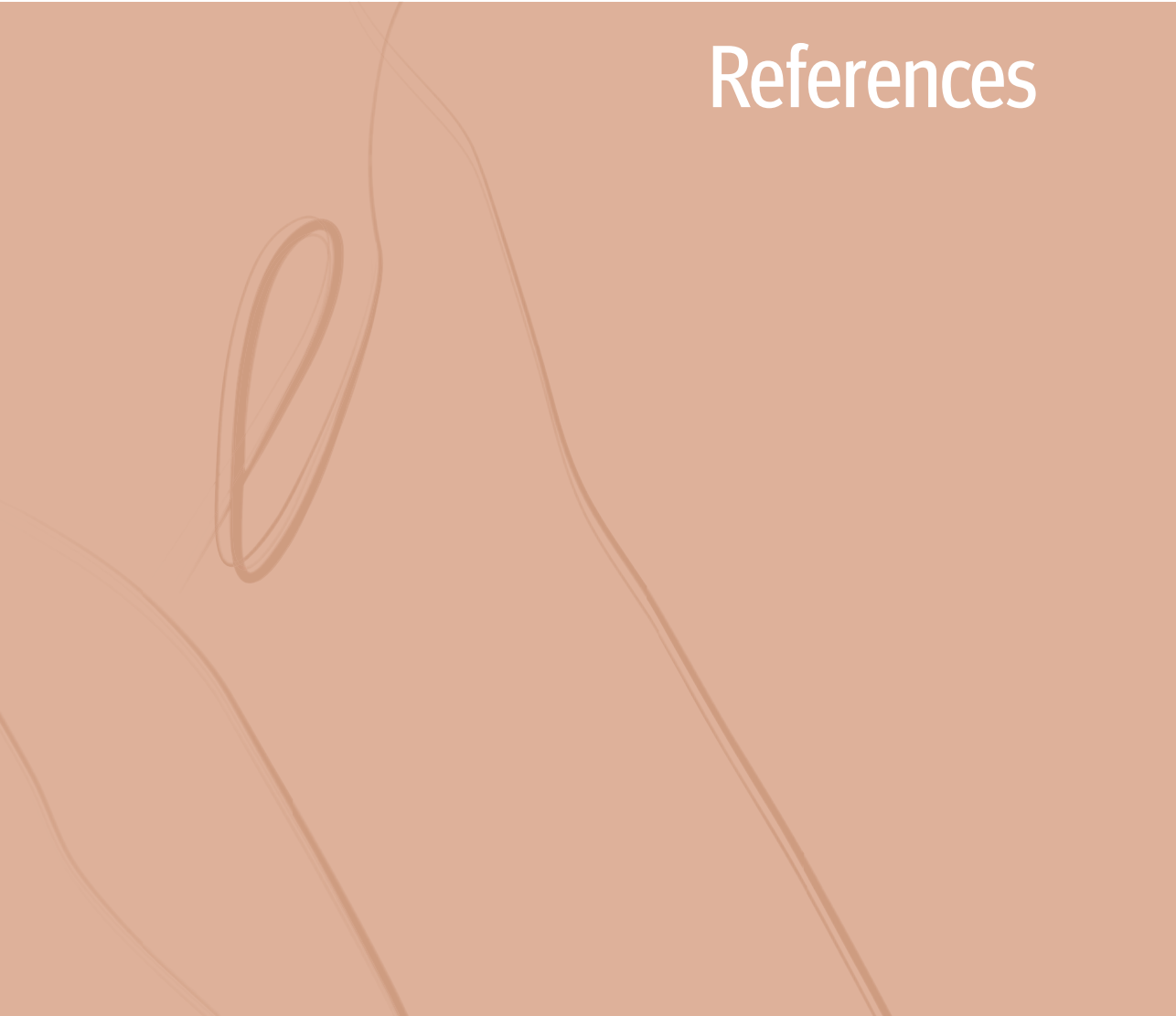
FFPE	formalin-fixed paraffin-embedded
FISH	fluorescence in-situ hybridization
FN	follicular neoplasm
FN/SFN	FN or suspicious for FN
FNAC	fine needle aspiration cytology
FN	false negative
FP	false positive
FTC	follicular thyroid carcinoma
FTC-OV	oncocytic variant of follicular thyroid carcinoma, currently known as OCA
FT-UMP	follicular tumour of unknown malignant potential
FVPTV	follicular variant of papillary thyroid carcinoma
GEC	gene expression classifier
GH	genome haploidization
GLCM	grey level co-occurrence matrix
GLM	generalized linear model
GLUT	glucose transporter
GMP	gene mutation panel
GWLOH	genome-wide loss of heterozygosity
H&E	hematoxylin and eosin
HBME-1	Hector Battifora mesothelial-1
HCA	Hürthle cell adenoma, currently known as OA
HCC	Hürthle cell carcinoma, currently known as OCA
HCN	Hürthle cell neoplasm, currently known as OCN
HCN/SHCN	HCN or suspicious for HCN, currently known as O-FN
HIF1a	hypoxia-inducible factor-1 alpha
HK	hexokinase
HMGA	high mobility group AT-hook
HRM	high-resolution melting (analysis)
HRQoL	health-related quality of life
hTERT	human telomerase reverse transcription
HT	hemithyroidectomy
HU	Houndsfield units
IBSI	Image Biomarker Standardisation Initiative
ICC	immunocytochemistry
ICCRTC	Italian consensus for the classification and reporting of thyroid cytology
i.e.	id est, that is
IHC	immunohistochemistry
iMCQ	iMTA Medical Consumption Questionnaire
iPCQ	iMTA Productivity Costs Questionnaire
IQR	interquartile range
ITN	indeterminate thyroid nodules
kPa	kilopascals
LAIR	lesser-allele intensity-ratio
IdCT	low-dose CT

LOH	loss of heterozygosity
LR	likelihood ratio
MALDI-MSI	matrix-assisted laser desorption ionization / mass spectrometry imaging
MAPK	mitogen-activated protein kinase
mAs	milliamperage × seconds
MCS	mental component score
MCT ₄	monocarboxylate transporter 4
MD	molecular diagnostics
MeSH	Medical Subject Headings
mi-OCA	minimally invasive OCA
MIC	minimally important change
MIP	maximum intensity projection
miRNA	microRNA
mPTC	papillary microcarcinoma
MRI	magnetic resonance imaging
MRS	magnetic resonance spectroscopy
MTC	medullary thyroid carcinoma
NBIA	National Biomedical Imaging Archive
NCI	National Cancer Institute
NGS	next generation sequencing
NHGRI	National Human Genome Research Institute
NH-H	nodular hyperplasia with oncocytic cell metaplasia
NIFTP	non-invasive follicular thyroid neoplasm with papillary-like nuclear features
NIS	sodium-iodide symporter
NPV	negative predictive value
OA	oncocytic (thyroid) adenoma, formerly HCA
OCA	oncocytic (thyroid) carcinoma, formerly HCC
OCN	oncocytic cell (thyroid) neoplasm, formerly HCN
O-FN	oncocytic follicular neoplasm
OR	odds ratio
PCR	polymerase chain reaction
PCS	physical component score
PET	positron emission tomography
PET/CT	positron emission tomography/computed tomography
PPAR γ	peroxisome proliferator-activated receptor γ
PPV	positive predictive value
PRISMA	preferred reporting items for systematic reviews and meta-analyses
PTC	papillary thyroid carcinoma
QALY	quality-adjusted life year
QUADAS	quality assessment of diagnostic accuracy studies
RAF	rapidly accelerated fibrosarcoma
RAI	radioactive iodine
RAS	rat sarcoma virus
RCI	reciprocal chromosomal imbalance

RCT	randomized controlled trial
READ	real-time exonuclease-mediated allelic discrimination
rhTSH	recombinant human thyrotropin
RI	retention index
RNA	ribonucleic acid
ROC	receiver operating characteristic
ROI	range of interest, region of interest
ROM	risk of malignancy
r_s	Spearman's rank correlation coefficient
SHCN	suspicious for Hürthle cell neoplasm, currently known as O-FN
SPECT	single-photon emission computed tomography
SROC	summary receiver operating characteristic
SUV	standardized uptake value
SUV_{max}	maximum standardized uptake value
SUV_{peak}	peak standardized uptake value
TBSRTC	the Bethesda System for Reporting Thyroid Cytopathology
TCGA	the cancer genome atlas
ThyPRO	thyroid patient-reported outcome
TIRADS	thyroid imaging reporting and data system
TLG	total lesion glycolysis
TN	true negative
TP	true positive
TPO	thyroid peroxidase
TRK	tyrosine receptor kinase
TROP-2	trophoblast cell surface antigen-2
TT	total thyroidectomy
TUMP	tumour of unknown malignant potential
US	ultrasound
USE	ultrasound elastosonography
VAF	variant allele frequency
VAS	visual analogue scale
VE1	BRAF ^{V600E} specific antibody
VEGF	vascular endothelial growth factor
VOI	volume of interest
wi-OCA	widely invasive OCA
WO_{ind}	wash-out index
WTP	willingness to pay
XAI	explainable artificial intelligence



References

The background of the page is a solid orange color. On the left side, there are several thin, white, hand-drawn style lines. One prominent line forms a large, open loop that extends from the middle of the page down towards the bottom left corner. Other lines are more fragmented and scattered across the left half of the page.

References

1. Uppal N, Collins R, James B. Thyroid nodules: Global, economic, and personal burdens. *Frontiers in endocrinology*. 2023;14:1113977. <https://doi.org/10.3389/fendo.2023.1113977>.
2. Rossi ED, Baloch Z. The Impact of the 2022 WHO Classification of Thyroid Neoplasms on Everyday Practice of Cytopathology. *Endocrine pathology*. 2023;34:23-33. <https://doi.org/10.1007/s12022-023-09756-2>.
3. Vander JB, Gaston EA, Dawber TR. The significance of nontoxic thyroid nodules. Final report of a 15-year study of the incidence of thyroid malignancy. *Annals of internal medicine*. 1968;69:537-540. <https://doi.org/10.7326/0003-4819-69-3-537>.
4. Tunbridge WM, Evered DC, Hall R, Appleton D, Brewis M, Clark F, et al. The spectrum of thyroid disease in a community: the Whickham survey. *Clinical endocrinology*. 1977;7:481-493. <https://doi.org/10.1111/j.1365-2265.1977.tb01340.x>.
5. Mazzaferri EL. Management of a solitary thyroid nodule. *The New England journal of medicine*. 1993;328:553-559. <https://doi.org/10.1056/NEJM199302253280807>.
6. Sosa JA, Hanna JW, Robinson KA, Lanman RB. Increases in thyroid nodule fine-needle aspirations, operations, and diagnoses of thyroid cancer in the United States. *Surgery*. 2013;154:1420-1426; discussion 1426-1427. <https://doi.org/10.1016/j.surg.2013.07.006>.
7. Powers AE, Marcadis AR, Lee M, Morris LGT, Marti JL. Changes in Trends in Thyroid Cancer Incidence in the United States, 1992 to 2016. *JAMA*. 2019;322:2440-2441. <https://doi.org/10.1001/jama.2019.18528>.
8. ECIS. European Cancer Information System. <https://ecis.jrc.ec.europa.eu>. Accessed 03/10/2023.
9. IKNL. NKR cijfers - Schildklierkanker, incidentie per jaar. <https://iknl.nl/nkr-cijfers>. Accessed 03/10/2023.
10. Ahn HS, Kim HJ, Welch HG. Korea's thyroid-cancer "epidemic"--screening and overdiagnosis. *The New England journal of medicine*. 2014;371:1765-1767. <https://doi.org/10.1056/NEJMp1409841>.
11. Lim H, Devesa SS, Sosa JA, Check D, Kitahara CM. Trends in Thyroid Cancer Incidence and Mortality in the United States, 1974-2013. *JAMA*. 2017;317:1338-1348. <https://doi.org/10.1001/jama.2017.2719>.
12. Wang C, Wu Z, Lei L, Dong X, Cao W, Luo Z, et al. Geographic disparities in trends of thyroid cancer incidence and mortality from 1990 to 2019 and a projection to 2030 across income-classified countries and territories. *J Glob Health*. 2023;13:04108. <https://doi.org/10.7189/jogh.13.04108>.
13. Ullmann TM, Papaleontiou M, Sosa JA. Current Controversies in Low-Risk Differentiated Thyroid Cancer: Reducing Overtreatment in an Era of Overdiagnosis. *The Journal of clinical endocrinology and metabolism*. 2023;108:271-280. <https://doi.org/10.1210/clinem/dgac646>.
14. Kovatch KJ, Hoban CW, Shuman AG. Thyroid cancer surgery guidelines in an era of de-escalation. *European journal of surgical oncology*. 2018;44:297-306. <https://doi.org/10.1016/j.ejso.2017.03.005>.
15. Durante C, Hegedus L, Czarniecka A, Paschke R, Russ G, Schmitt F, et al. 2023 European Thyroid Association Clinical Practice Guidelines for thyroid nodule management. *Eur Thyroid J*. 2023;12. <https://doi.org/10.1530/ETJ-23-0067>.
16. Cibas ES, Ali SZ. The Bethesda System for Reporting Thyroid Cytopathology. *Thyroid*. 2009;19:1159-1165. <https://doi.org/10.1089/thy.2009.0274>.
17. 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;26:1-133. <https://doi.org/10.1089/thy.2015.0020>.
18. Cibas ES, Ali SZ. The 2017 Bethesda System for Reporting Thyroid Cytopathology. *Thyroid*. 2017;27:1341-1346. <https://doi.org/10.1089/thy.2017.0500>.
19. Haugen BR, Sawka AM, Alexander EK, Bible KC, Caturegli P, Doherty GM, et al. American Thyroid Association Guidelines on the Management of Thyroid Nodules and Differentiated Thyroid Cancer Task Force Review and Recommendation on the Proposed Renaming of Encapsulated Follicular Variant Papillary Thyroid Carcinoma Without Invasion to Noninvasive Follicular Thyroid Neoplasm with Papillary-Like Nuclear Features. *Thyroid*. 2017;27:481-483. <https://doi.org/10.1089/thy.2016.0628>.
20. Lloyd RV, Osamura RY, Klöppel G, Rosai J. WHO classification of tumours of endocrine organs. WHO classification of tumours, 4th ed. Lyon, France: IARC; 2017.
21. Baloch ZW, Asa SL, Barletta JA, Ghossein RA, Juhlin CC, Jung CK, et al. Overview of the 2022 WHO Classification of Thyroid Neoplasms. *Endocrine pathology*. 2022;33:27-63. <https://doi.org/10.1007/s12022-022-09707-3>.

22. Board WCoTE. WHO classification of endocrine and neuroendocrine tumours. WHO classification of tumours, 5th ed. 2022. <https://tumourclassification.iarc.who.int/welcome/#>. Accessed
23. Ali SZ, Baloch ZW, Cochand-Priollet B, Schmitt FC, Vielh P, VanderLaan PA. The 2023 Bethesda System for reporting thyroid cytopathology. *J Am Soc Cytopathol*. 2023. <https://doi.org/10.1016/j.jasc.2023.05.005>.
24. Nikiforov YE, Seethala RR, Tallini G, Baloch ZW, Basolo F, Thompson LD, et al. Nomenclature Revision for Encapsulated Follicular Variant of Papillary Thyroid Carcinoma: A Paradigm Shift to Reduce Overtreatment of Indolent Tumors. *JAMA Oncol*. 2016;2:1023-1029. <https://doi.org/10.1001/jamaoncol.2016.0386>.
25. de Koster EJ, de Geus-Oei LF, Dekkers OM, van Engen-van Grunsven I, Hamming J, Corssmit EPM, et al. Diagnostic Utility of Molecular and Imaging Biomarkers in Cytological Indeterminate Thyroid Nodules. *Endocr Rev*. 2018;39:154-191. <https://doi.org/10.1210/er.2017-00133>.
26. Cibas ES, Baloch ZW, Fellegara G, LiVolsi VA, Raab SS, Rosai J, et al. A prospective assessment defining the limitations of thyroid nodule pathologic evaluation. *Annals of internal medicine*. 2013;159:325-332. <https://doi.org/10.7326/0003-4819-159-5-201309030-00006>.
27. Ali SZ, Baloch ZW, Cochand-Priollet B, Schmitt FC, Vielh P, VanderLaan PA. The 2023 Bethesda System for Reporting Thyroid Cytopathology. *Thyroid*. 2023. <https://doi.org/10.1089/thy.2023.0141>.
28. de Koster EJ, Vriens D, van Aken MO, Dijkhorst-Oei LT, Oyen WJG, Peeters RP, et al. FDG-PET/CT in indeterminate thyroid nodules: cost-utility analysis alongside a randomised controlled trial. *Eur J Nucl Med Mol Imaging*. 2022;49:3452-3469. <https://doi.org/10.1007/s00259-022-05794-w>.
29. Vriens D, Adang EM, Netea-Maier RT, Smit JW, de Wilt JH, Oyen WJ, et al. Cost-effectiveness of FDG-PET/CT for cytologically indeterminate thyroid nodules: a decision analytic approach. *The Journal of clinical endocrinology and metabolism*. 2014;99:3263-3274. <https://doi.org/10.1210/jc.2013-3483>.
30. Bossuyt PM, Reitsma JB, Linnet K, Moons KG. Beyond diagnostic accuracy: the clinical utility of diagnostic tests. *Clin Chem*. 2012;58:1636-1643. <https://doi.org/10.1373/clinchem.2012.182576>.
31. Lijmer JG, Leeflang M, Bossuyt PM. Proposals for a phased evaluation of medical tests. *Medical decision making*. 2009;29:E13-21. <https://doi.org/10.1177/0272989X09336144>.
32. Fryback DG, Thornbury JR. The efficacy of diagnostic imaging. *Medical decision making*. 1991;11:88-94. <https://doi.org/10.1177/0272989X9101100203>.
33. Rodger M, Ramsay T, Fergusson D. Diagnostic randomized controlled trials: the final frontier. *Trials*. 2012;13:137. <https://doi.org/10.1186/1745-6215-13-137>.
34. Bossuyt PM, Lijmer JG, Mol BW. Randomised comparisons of medical tests: sometimes invalid, not always efficient. *Lancet*. 2000;356:1844-1847. [https://doi.org/10.1016/S0140-6736\(00\)03246-3](https://doi.org/10.1016/S0140-6736(00)03246-3).
35. Ferrante di Ruffano L, Dinnes J, Sitch AJ, Hyde C, Deeks JJ. Test-treatment RCTs are susceptible to bias: a review of the methodological quality of randomized trials that evaluate diagnostic tests. *BMC medical research methodology*. 2017;17:35. <https://doi.org/10.1186/s12874-016-0287-z>.
36. Upadhyay M, Samal J, Kandpal M, Singh OV, Vivekanandan P. The Warburg effect: insights from the past decade. *Pharmacol Ther*. 2013;137:318-330. <https://doi.org/10.1016/j.pharmthera.2012.11.003>.
37. de Geus-Oei LF, Pieters GF, Bonenkamp JJ, Mudde AH, Bleeker-Rovers CP, Corstens FH, et al. 18F-FDG PET reduces unnecessary hemithyroidectomies for thyroid nodules with inconclusive cytologic results. *Journal of nuclear medicine*. 2006;47:770-775.
38. 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;117:4582-4594. <https://doi.org/10.1002/cncr.26085>.
39. Merten MM, Castro MR, Zhang J, Durski JM, Ryder M. Examining the Role of Preoperative Positron Emission Tomography/Computerized Tomography (PET/CT) in Combination with Ultrasonography in Discriminating Benign from Malignant Cytologically Indeterminate Thyroid Nodules. *Thyroid*. 2017;27:95-102. <https://doi.org/10.1089/thy.2016.0379>.
40. Piccardo A, Puntoni M, Dezzana M, Bottoni G, Foppiani L, Marugo A, et al. Indeterminate thyroid nodules. The role of (18)F-FDG PET/CT in the "era" of ultrasonography risk stratification systems and new thyroid cytology classifications. *Endocrine*. 2020;69:553-561. <https://doi.org/10.1007/s12020-020-02239-y>.
41. Gupta N, Dasyam AK, Carty SE, Nikiforova MN, Ohori NP, Armstrong M, et al. RAS mutations in thyroid FNA specimens are highly predictive of predominantly low-risk follicular-pattern cancers. *The Journal of clinical endocrinology and metabolism*. 2013;98:E914-922. <https://doi.org/10.1210/jc.2012-3396>.
42. Zhu Z, Gandhi M, Nikiforova MN, Fischer AH, Nikiforov YE. Molecular profile and clinical-pathologic features of the follicular variant of papillary thyroid carcinoma. An unusually high prevalence of ras mutations. *American journal of clinical pathology*. 2003;120:71-77. <https://doi.org/10.1309/ND8D-9LAJ-TRCT-G6QD>.

43. Lee SR, Jung CK, Kim TE, Bae JS, Jung SL, Choi YJ, et al. Molecular genotyping of follicular variant of papillary thyroid carcinoma correlates with diagnostic category of fine-needle aspiration cytology: values of RAS mutation testing. *Thyroid*. 2013;23:1416-1422. <https://doi.org/10.1089/thy.2012.0640>.
44. Cibas ES, Ali SZ, Conference NCITFSotS. The Bethesda System For Reporting Thyroid Cytopathology. *American journal of clinical pathology*. 2009;132:658-665. <https://doi.org/10.1309/AJCPHLWMI3JV4LA>.
45. Mitchell AL, Gandhi A, Scott-Coombes D, Perros P. Management of thyroid cancer: United Kingdom National Multidisciplinary Guidelines. *The Journal of laryngology and otology*. 2016;130:S150-S160. <https://doi.org/10.1017/S0022215116000578>.
46. Nardi F, Basolo F, Crescenzi A, Fadda G, Frasoldati A, Orlandi F, et al. Italian consensus for the classification and reporting of thyroid cytology. *Journal of endocrinological investigation*. 2014;37:593-599. <https://doi.org/10.1007/s40618-014-0062-0>.
47. Brito JP, Al Nofal A, Montori VM, Hay ID, Morris JC. The Impact of Subclinical Disease and Mechanism of Detection on the Rise in Thyroid Cancer Incidence: A Population-Based Study in Olmsted County, Minnesota During 1935 Through 2012. *Thyroid*. 2015;25:999-1007. <https://doi.org/10.1089/thy.2014.0594>.
48. Fazeli R, Schneider EB, Ali SZ, Zeiger MA, Olson MT. Diagnostic Frequency Ratios Are Insufficient to Measure Laboratory Precision with The Bethesda System for Reporting Thyroid Cytopathology. *Acta cytologica*. 2015;59:225-232. <https://doi.org/10.1159/000379738>.
49. Bongiovanni M, Spitale A, Faquin WC, Mazzucchelli L, Baloch ZW. The Bethesda System for Reporting Thyroid Cytopathology: a meta-analysis. *Acta cytologica*. 2012;56:333-339. <https://doi.org/10.1159/000339959>.
50. Sullivan PS, Hirschowitz SL, Fung PC, Apple SK. The impact of atypia/follicular lesion of undetermined significance and repeat fine-needle aspiration: 5 years before and after implementation of the Bethesda System. *Cancer cytopathology*. 2014;122:866-872. <https://doi.org/10.1002/cncy.21468>.
51. Caplan RH, Wester SM, Lambert PJ, Rooney BL. Efficient evaluation of thyroid nodules by primary care providers and thyroid specialists. *The American journal of managed care*. 2000;6:1134-1140.
52. Khalid AN, Quraishi SA, Hollenbeak CS, Stack BC, Jr. Fine-needle aspiration biopsy versus ultrasound-guided fine-needle aspiration biopsy: cost-effectiveness as a frontline diagnostic modality for solitary thyroid nodules. *Head & neck*. 2008;30:1035-1039. <https://doi.org/10.1002/hed.20829>.
53. Vriens D, Adang EM, Netea-Maier RT, Smit JW, de Wilt JH, Oyen WJ, et al. Cost-effectiveness of FDG-PET/CT for cytologically indeterminate thyroid nodules: a decision analytic approach. *The Journal of clinical endocrinology and metabolism*. 2014;99:3263-3274. <https://doi.org/10.1210/jc.2013-3483>.
54. McHenry CR, Slusarczyk SJ. Hypothyroidism following hemithyroidectomy: incidence, risk factors, and management. *Surgery*. 2000;128:994-998. <https://doi.org/10.1067/msy.2000.110242>.
55. Rosato L, Avenia N, Bernante P, De Palma M, Gulino G, Nasi PG, et al. Complications of thyroid surgery: analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years. *World journal of surgery*. 2004;28:271-276. <https://doi.org/10.1007/s00268-003-6903-1>.
56. Jeannon JP, Orabi AA, Bruch GA, Abdalsalam HA, Simo R. Diagnosis of recurrent laryngeal nerve palsy after thyroidectomy: a systematic review. *Int J Clin Pract*. 2009;63:624-629. <https://doi.org/10.1111/j.1742-1241.2008.01875.x>.
57. Samir AE, Dhyani M, Anvari A, Prescott J, Halpern EF, Faquin WC, et al. Shear-Wave Elastography for the Preoperative Risk Stratification of Follicular-patterned Lesions of the Thyroid: Diagnostic Accuracy and Optimal Measurement Plane. *Radiology*. 2015;141627. <https://doi.org/10.1148/radiol.2015141627>.
58. Piccardo A, Puntoni M, Treglia G, Foppiani L, Bertagna F, Paparo F, et al. Thyroid nodules with indeterminate cytology: prospective comparison between 18F-FDG-PET/CT, multiparametric neck ultrasonography, 99mTc-MIBI scintigraphy and histology. *European journal of endocrinology*. 2016. <https://doi.org/10.1530/eje-15-1199>.
59. Munoz Perez N, Villar del Moral JM, Muros Fuentes MA, Lopez de la Torre M, Arcelus Martinez JI, Becerra Massare P, et al. Could 18F-FDG-PET/CT avoid unnecessary thyroidectomies in patients with cytological diagnosis of follicular neoplasm? *Langenbeck's archives of surgery / Deutsche Gesellschaft fur Chirurgie*. 2013;398:709-716. <https://doi.org/10.1007/s00423-013-1070-9>.
60. Nikiforov YE, Carty SE, Chiosea SI, Coyne C, Duvvuri U, Ferris RL, et al. Impact of the Multi-Gene ThyroSeq Next-Generation Sequencing Assay on Cancer Diagnosis in Thyroid Nodules with Atypia of Undetermined Significance/ Follicular Lesion of Undetermined Significance Cytology. *Thyroid*. 2015;25:1217-1223. <https://doi.org/10.1089/thy.2015.0305>.
61. Labourier E, Shifrin A, Busseniers AE, Lupo MA, Manganelli ML, Andruss B, et al. Molecular Testing for miRNA, mRNA, and DNA on Fine-Needle Aspiration Improves the Preoperative Diagnosis of Thyroid Nodules With Indeterminate Cytology. *The Journal of clinical endocrinology and metabolism*. 2015;100:2743-2750. <https://doi.org/10.1210/jc.2015-1158>.
62. Kimura ET, Nikiforova MN, Zhu Z, Knauf JA, Nikiforov YE, Fagin JA. High prevalence of BRAF mutations in thyroid cancer: genetic evidence for constitutive activation of the RET/PTC-RAS-BRAF signaling pathway in papillary thyroid carcinoma. *Cancer Res*. 2003;63:1454-1457.

63. Adeniran AJ, Zhu Z, Gandhi M, Steward DL, Fidler JP, Giordano TJ, et al. Correlation between genetic alterations and microscopic features, clinical manifestations, and prognostic characteristics of thyroid papillary carcinomas. *Am J Surg Pathol*. 2006;30:216-222.
64. Malumbres M, Barbacid M. RAS oncogenes: the first 30 years. *Nat Rev Cancer*. 2003;3:459-465. <https://doi.org/10.1038/nrc1097>.
65. Davies H, Bignell GR, Cox C, Stephens P, Edkins S, Clegg S, et al. Mutations of the BRAF gene in human cancer. *Nature*. 2002;417:949-954. <https://doi.org/10.1038/nature00766>.
66. Xing M. BRAF mutation in papillary thyroid cancer: pathogenic role, molecular bases, and clinical implications. *Endocr Rev*. 2007;28:742-762. <https://doi.org/10.1210/er.2007-0007>.
67. Rossi M, Buratto M, Tagliati F, Rossi R, Lupo S, Trasforini G, et al. Relevance of BRAF(V600E) mutation testing versus RAS point mutations and RET/PTC rearrangements evaluation in the diagnosis of thyroid cancer. *Thyroid*. 2015;25:221-228. <https://doi.org/10.1089/thy.2014.0338>.
68. Carr R, Ustun B, Chhieng D, Schofield K, Theoharis C, Hammers L, et al. Radiologic and clinical predictors of malignancy in the follicular lesion of undetermined significance of the thyroid. *Endocrine pathology*. 2013;24:62-68. <https://doi.org/10.1007/s12022-013-9240-4>.
69. Nikiforov YE, Ohori NP, Hodak SP, Carty SE, LeBeau SO, Ferris RL, et al. Impact of mutational testing on the diagnosis and management of patients with cytologically indeterminate thyroid nodules: a prospective analysis of 1056 FNA samples. *The Journal of clinical endocrinology and metabolism*. 2011;96:3390-3397. <https://doi.org/10.1210/jc.2011-1469>.
70. Nikiforova MN, Kimura ET, Gandhi M, Biddinger PW, Knauf JA, Basolo F, et al. BRAF mutations in thyroid tumors are restricted to papillary carcinomas and anaplastic or poorly differentiated carcinomas arising from papillary carcinomas. *The Journal of clinical endocrinology and metabolism*. 2003;88:5399-5404. <https://doi.org/10.1210/jc.2003-030838>.
71. Xing M. BRAF mutation in thyroid cancer. *Endocrine-related cancer*. 2005;12:245-262. <https://doi.org/10.1677/erc.1.0978>.
72. Kim SK, Hwang TS, Yoo YB, Han HS, Kim DL, Song KH, et al. Surgical results of thyroid nodules according to a management guideline based on the BRAF(V600E) mutation status. *The Journal of clinical endocrinology and metabolism*. 2011;96:658-664. <https://doi.org/10.1210/jc.2010-1082>.
73. Rossi M, Buratto M, Bruni S, Filieri C, Tagliati F, Trasforini G, et al. Role of ultrasonographic/clinical profile, cytology, and BRAF V600E mutation evaluation in thyroid nodule screening for malignancy: a prospective study. *The Journal of clinical endocrinology and metabolism*. 2012;97:2354-2361. <https://doi.org/10.1210/jc.2011-3494>.
74. Adeniran AJ, Hui P, Chhieng DC, Prasad ML, Schofield K, Theoharis C. BRAF mutation testing of thyroid fine-needle aspiration specimens enhances the predictability of malignancy in thyroid follicular lesions of undetermined significance. *Acta cytologica*. 2011;55:570-575. <https://doi.org/10.1159/000333274>.
75. Ohori NP, Wolfe J, Hodak SP, LeBeau SO, Yip L, Carty SE, et al. "Colloid-rich" follicular neoplasm/suspicious for follicular neoplasm thyroid fine-needle aspiration specimens: cytologic, histologic, and molecular basis for considering an alternate view. *Cancer cytopathology*. 2013;121:718-728. <https://doi.org/10.1002/cncy.21333>.
76. Eszlinger M, Piana S, Moll A, Bosenberg E, Bisagni A, Ciarrocchi A, et al. Molecular testing of thyroid fine-needle aspirations improves presurgical diagnosis and supports the histologic identification of minimally invasive follicular thyroid carcinomas. *Thyroid*. 2015;25:401-409. <https://doi.org/10.1089/thy.2014.0362>.
77. Hwang TS, Kim WY, Han HS, Lim SD, Kim WS, Yoo YB, et al. Preoperative RAS mutational analysis is of great value in predicting follicular variant of papillary thyroid carcinoma. *BioMed research international*. 2015;2015:697068. <https://doi.org/10.1155/2015/697068>.
78. Zhang Q, Liu SZ, Zhang Q, Guan YX, Chen QJ, Zhu QY. Meta-Analyses of Association Between BRAF(V600E) Mutation and Clinicopathological Features of Papillary Thyroid Carcinoma. *Cellular physiology and biochemistry*. 2016;38:763-776. <https://doi.org/10.1159/000443032>.
79. Yeo MK, Liang ZL, Oh T, Moon Y, An S, Kim MK, et al. Pyrosequencing cut-off value identifying BRAFV600E mutation in fine needle aspiration samples of thyroid nodules. *Clinical endocrinology*. 2011;75:555-560. <https://doi.org/10.1111/j.1365-2265.2011.04115.x>.
80. Pelizzo MR, Boschini IM, Barollo S, Pennelli G, Toniato A, Zamboni L, et al. BRAF analysis by fine needle aspiration biopsy of thyroid nodules improves preoperative identification of papillary thyroid carcinoma and represents a prognostic factor. A mono-institutional experience. *Clinical chemistry and laboratory medicine*. 2011;49:325-329. <https://doi.org/10.1515/cclm.2011.031>.
81. Xing M, Tufano RP, Tufano AP, Basaria S, Ewertz M, Rosenbaum E, et al. Detection of BRAF mutation on fine needle aspiration biopsy specimens: a new diagnostic tool for papillary thyroid cancer. *The Journal of clinical endocrinology and metabolism*. 2004;89:2867-2872. <https://doi.org/10.1210/jc.2003-032050>.
82. Sapio MR, Guerra A, Posca D, Limone PP, Deandrea M, Motta M, et al. Combined analysis of galectin-3 and BRAFV600E improves the accuracy of fine-needle aspiration biopsy with cytological findings suspicious for papillary thyroid carcinoma. *Endocrine-related cancer*. 2007;14:1089-1097. <https://doi.org/10.1677/erc-07-0147>.

83. Sapio MR, Posca D, Raggioli A, Guerra A, Marotta V, Deandrea M, et al. Detection of RET/PTC, TRK and BRAF mutations in preoperative diagnosis of thyroid nodules with indeterminate cytological findings. *Clinical endocrinology*. 2007;66:678-683. <https://doi.org/10.1111/j.1365-2265.2007.02800.x>.
84. Kim SK, Kim DL, Han HS, Kim WS, Kim SJ, Moon WJ, et al. Pyrosequencing analysis for detection of a BRAFV600E mutation in an FNAB specimen of thyroid nodules. *Diagnostic molecular pathology : the American journal of surgical pathology, part B*. 2008;17:118-125. <https://doi.org/10.1097/PDM.0b013e31815do59d>.
85. Jo YS, Huang S, Kim YJ, Lee IS, Kim SS, Kim JR, et al. Diagnostic value of pyrosequencing for the BRAF V600E mutation in ultrasound-guided fine-needle aspiration biopsy samples of thyroid incidentalomas. *Clinical endocrinology*. 2009;70:139-144. <https://doi.org/10.1111/j.1365-2265.2008.03293.x>.
86. Marchetti I, Lessi F, Mazzanti CM, Bertacca G, Elisei R, Coscio GD, et al. A morpho-molecular diagnosis of papillary thyroid carcinoma: BRAF V600E detection as an important tool in preoperative evaluation of fine-needle aspirates. *Thyroid*. 2009;19:837-842. <https://doi.org/10.1089/thy.2009.0074>.
87. Cantara S, Capezzone M, Marchisotta S, Capuano S, Busonero G, Toti P, et al. Impact of proto-oncogene mutation detection in cytological specimens from thyroid nodules improves the diagnostic accuracy of cytology. *The Journal of clinical endocrinology and metabolism*. 2010;95:1365-1369. <https://doi.org/10.1210/jc.2009-2103>.
88. Moses W, Weng J, Sansano I, Peng M, Khanafshar E, Ljung BM, et al. Molecular testing for somatic mutations improves the accuracy of thyroid fine-needle aspiration biopsy. *World journal of surgery*. 2010;34:2589-2594. <https://doi.org/10.1007/s00268-010-0720-0>.
89. Adeniran AJ, Theoharis C, Hui P, Prasad ML, Hammers L, Carling T, et al. Reflex BRAF testing in thyroid fine-needle aspiration biopsy with equivocal and positive interpretation: a prospective study. *Thyroid*. 2011;21:717-723. <https://doi.org/10.1089/thy.2011.0021>.
90. Patel A, Klubo-Gwiezdinska J, Hoperia V, Larin A, Jensen K, Bauer A, et al. BRAF(V600E) mutation analysis from May-Grunwald Giemsa-stained cytological samples as an adjunct in identification of high-risk papillary thyroid carcinoma. *Endocrine pathology*. 2011;22:195-199. <https://doi.org/10.1007/s12022-011-9180-9>.
91. Canadas-Garre M, Becerra-Massare P, Lopez de la Torre-Casares M, Villar-del Moral J, Cespedes-Mas S, Vilchez-Joya R, et al. Reduction of false-negative papillary thyroid carcinomas by the routine analysis of BRAF(T1799A) mutation on fine-needle aspiration biopsy specimens: a prospective study of 814 thyroid FNAB patients. *Annals of surgery*. 2012;255:986-992. <https://doi.org/10.1097/SLA.0b013e31824e8d70>.
92. Kang G, Cho EY, Shin JH, Chung JH, Kim JW, Oh YL. Role of BRAFV600E mutation analysis and second cytologic review of fine-needle aspiration for evaluating thyroid nodule. *Cancer cytopathology*. 2012;120:44-51. <https://doi.org/10.1002/cncy.20179>.
93. Mancini I, Pinzani P, Pupilli C, Petrone L, De Feo ML, Bencini L, et al. A high-resolution melting protocol for rapid and accurate differential diagnosis of thyroid nodules. *The Journal of molecular diagnostics*. 2012;14:501-509. <https://doi.org/10.1016/j.jmoldx.2012.03.003>.
94. Tonacchera M, Agretti P, Rago T, De Marco G, Niccolai F, Molinaro A, et al. Genetic markers to discriminate benign and malignant thyroid nodules with undetermined cytology in an area of borderline iodine deficiency. *Journal of endocrinological investigation*. 2012;35:754-759. <https://doi.org/10.3275/8012>.
95. Kloos RT, Reynolds JD, Walsh PS, Wilde JJ, Tom EY, Pagan M, et al. Does addition of BRAF V600E mutation testing modify sensitivity or specificity of the Afirma Gene Expression Classifier in cytologically indeterminate thyroid nodules? *The Journal of clinical endocrinology and metabolism*. 2013;98:E761-768. <https://doi.org/10.1210/jc.2012-3762>.
96. Agretti P, Niccolai F, Rago T, De Marco G, Molinaro A, Scutari M, et al. BRAF mutation analysis in thyroid nodules with indeterminate cytology: our experience on surgical management of patients with thyroid nodules from an area of borderline iodine deficiency. *Journal of endocrinological investigation*. 2014;37:1009-1014. <https://doi.org/10.1007/s40618-014-0166-6>.
97. Beaudenon-Huibregtse S, Alexander EK, Guttler RB, Hershman JM, Babu V, Blevins TC, et al. Centralized molecular testing for oncogenic gene mutations complements the local cytopathologic diagnosis of thyroid nodules. *Thyroid*. 2014;24:1479-1487. <https://doi.org/10.1089/thy.2013.0640>.
98. Danilovic DL, Lima EU, Domingues RB, Brandao LG, Hoff AO, Marui S. Pre-operative role of BRAF in the guidance of the surgical approach and prognosis of differentiated thyroid carcinoma. *European journal of endocrinology*. 2014;170:619-625. <https://doi.org/10.1530/eje-13-0944>.
99. Eszlinger M, Krogdahl A, Munz S, Rehfeld C, Precht Jensen EM, Ferraz C, et al. Impact of molecular screening for point mutations and rearrangements in routine air-dried fine-needle aspiration samples of thyroid nodules. *Thyroid*. 2014;24:305-313. <https://doi.org/10.1089/thy.2013.0278>.
100. Eszlinger M, Neustadt M, Ruschenburg I, Neumann A, Franzius C, Adam S, et al. [Fine-needle aspiration cytology of thyroid nodules: molecular diagnostics in a routine diagnostic setting]. *Deutsche medizinische Wochenschrift*. 2014;139:476-480. <https://doi.org/10.1055/s-0034-1369883>.
101. Johnson SJ, Hardy SA, Roberts C, Bourn D, Mallick U, Perros P. Pilot of BRAF mutation analysis in indeterminate, suspicious and malignant thyroid FNA cytology. *Cytopathology*. 2014;25:146-154. <https://doi.org/10.1111/cyt.12125>.

102. Liu S, Gao A, Zhang B, Zhang Z, Zhao Y, Chen P, et al. Assessment of molecular testing in fine-needle aspiration biopsy samples: an experience in a Chinese population. *Experimental and molecular pathology*. 2014;97:292-297. <https://doi.org/10.1016/j.yexmp.2014.08.005>.
103. Poller DN, Glaysher S, Agrawal A, Caldera S, Kim D, Yiangou C. BRAF V600 co-testing in thyroid FNA cytology: short-term experience in a large cancer centre in the UK. *Journal of clinical pathology*. 2014;67:684-689. <https://doi.org/10.1136/jclinpath-2014-202348>.
104. Seo JY, Kim EK, Kwak JY. Additional BRAF mutation analysis may have additional diagnostic value in thyroid nodules with "suspicious for malignant" cytology alone even when the nodules do not show suspicious US features. *Endocrine*. 2014;47:283-289. <https://doi.org/10.1007/s12020-013-0150-5>.
105. Borrelli N, Ugolini C, Giannini R, Antonelli A, Giordano M, Sensi E, et al. Role of gene expression profiling in defining indeterminate thyroid nodules in addition to BRAF analysis. *Cancer cytopathology*. 2015. <https://doi.org/10.1002/cncy.21681>.
106. Capelli L, Marfisi C, Puccetti M, Saragoni L, De Paola F, Zaccaroni A, et al. Role of BRAF molecular analysis in the management of papillary thyroid carcinoma: analysis of cytological and histological samples. *Cytopathology*. 2015;26:297-302. <https://doi.org/10.1111/cyt.12199>.
107. Gill MS, Nayan S, Kocovski L, Cutz JC, Archibald SD, Jackson BS, et al. Local molecular analysis of indeterminate thyroid nodules. *Journal of otolaryngology - head & neck surgery*. 2015;44:52. <https://doi.org/10.1186/s40463-015-0106-2>.
108. Giovannella L, Campenni A, Treglia G, Verburg FA, Trimboli P, Ceriani L, et al. Molecular imaging with Tc-MIBI and molecular testing for mutations in differentiating benign from malignant follicular neoplasm: a prospective comparison. *European journal of nuclear medicine and molecular imaging*. 2015. <https://doi.org/10.1007/s00259-015-3285-1>.
109. Le Mercier M, D'Haene N, De Neve N, Blanchard O, Degand C, Rorive S, et al. Next-generation sequencing improves the diagnosis of thyroid FNA specimens with indeterminate cytology. *Histopathology*. 2015;66:215-224. <https://doi.org/10.1111/his.12461>.
110. Marino M, Monzani ML, Brigante G, Cioni K, Madeo B, Santi D, et al. High-Resolution Melting Is a Sensitive, Cost-Effective, Time-Saving Technique for BRAF V600E Detection in Thyroid FNAB Washing Liquid: A Prospective Cohort Study. *European Thyroid Journal*. 2015;4:73-81.
111. Park KS, Oh YL, Ki CS, Kim JW. Evaluation of the Real-Q BRAF V600E Detection Assay in Fine-Needle Aspiration Samples of Thyroid Nodules. *The Journal of molecular diagnostics*. 2015;17:431-437. <https://doi.org/10.1016/j.jmoldx.2015.03.006>.
112. Beisa A, Beisa V, Stoskus M, Ostaneviciute E, Griskevicius L, Strupas K. The value of the repeated examination of BRAF V600E mutation status in diagnostics of papillary thyroid cancer. *Endokrynologia Polska*. 2016;67:35-40. <https://doi.org/10.5603/ep.2016.0005>.
113. Kowalska A, Kowalik A, Palyga I, Walczyk A, Gasior-Perczak D, Kopczynski J, et al. The usefulness of determining the presence of BRAF V600E mutation in fine-needle aspiration cytology in indeterminate cytological results. *Endokrynologia Polska*. 2016;67:41-47. <https://doi.org/10.5603/ep.2016.0006>.
114. Valderrabano P, Leon ME, Centeno BA, Otto KJ, Khazai L, McCaffrey JC, et al. Institutional prevalence of malignancy of indeterminate thyroid cytology is necessary but insufficient to accurately interpret molecular marker tests. *European journal of endocrinology / European Federation of Endocrine Societies*. 2016. <https://doi.org/10.1530/eje-15-1163>.
115. Kim SW, Lee JJ, Kim JW, Ki CS, Oh YL, Choi YL, et al. BRAFV600E mutation analysis in fine-needle aspiration cytology specimens for evaluation of thyroid nodule: a large series in a BRAFV600E-prevalent population. *The Journal of clinical endocrinology and metabolism*. 2010;95:3693-3700. <https://doi.org/10.1210/jc.2009-2795>.
116. Koh J, Choi JR, Han KH, Kim EK, Yoon JH, Moon HJ, et al. Proper indication of BRAF(V600E) mutation testing in fine-needle aspirates of thyroid nodules. *PLoS one*. 2013;8:e64505. <https://doi.org/10.1371/journal.pone.0064505>.
117. Leslie C, Grieco-Iacopetta F, Richter A, Platten M, Murray J, Frost FA, et al. BRAF p.Val600Glu (V600E) mutation detection in thyroid fine needle aspiration cell block samples: a feasibility study. *Pathology*. 2015;47:432-438. <https://doi.org/10.1097/pat.0000000000000273>.
118. Nikiforov YE, Carty SE, Chiosea SI, Coyne C, Duvvuri U, Ferris RL, et al. Highly accurate diagnosis of cancer in thyroid nodules with follicular neoplasm/suspicious for a follicular neoplasm cytology by ThyroSeq v2 next-generation sequencing assay. *Cancer*. 2014;120:3627-3634. <https://doi.org/10.1002/cncr.29038>.
119. Jeong SH, Hong HS, Lee EH, Cha JG, Park JS, Kwak JJ. Outcome of thyroid nodules characterized as atypia of undetermined significance or follicular lesion of undetermined significance and correlation with Ultrasound features and BRAF(V600E) mutation analysis. *AJR American journal of roentgenology*. 2013;201:W854-860. <https://doi.org/10.2214/ajr.12.9901>.
120. Hyeon J, Ahn S, Shin JH, Oh YL. The prediction of malignant risk in the category "atypia of undetermined significance/follicular lesion of undetermined significance" of the Bethesda System for Reporting Thyroid Cytopathology using subcategorization and BRAF mutation results. *Cancer cytopathology*. 2014;122:368-376. <https://doi.org/10.1002/cncy.21396>.

121. Park HJ, Moon JH, Yom CK, Kim KH, Choi JY, Choi SI, et al. Thyroid “atypia of undetermined significance” with nuclear atypia has high rates of malignancy and BRAF mutation. *Cancer cytopathology*. 2014;122:512-520. <https://doi.org/10.1002/cncy.21411>.
122. Lee ST, Kim SW, Ki CS, Jang JH, Shin JH, Oh YL, et al. Clinical implication of highly sensitive detection of the BRAF V600E mutation in fine-needle aspirations of thyroid nodules: a comparative analysis of three molecular assays in 4585 consecutive cases in a BRAF V600E mutation-prevalent area. *The Journal of clinical endocrinology and metabolism*. 2012;97:2299-2306. <https://doi.org/10.1210/jc.2011-3135>.
123. Ohori NP, Singhal R, Nikiforova MN, Yip L, Schoedel KE, Coyne C, et al. BRAF mutation detection in indeterminate thyroid cytology specimens: underlying cytologic, molecular, and pathologic characteristics of papillary thyroid carcinoma. *Cancer cytopathology*. 2013;121:197-205. <https://doi.org/10.1002/cncy.21229>.
124. Afkhami M, Karunamurthy A, Chiosea S, Nikiforova MN, Seethala R, Nikiforov YE, et al. Histopathologic and Clinical Characterization of Thyroid Tumors Carrying the BRAF(K601E) Mutation. *Thyroid*. 2016;26:242-247. <https://doi.org/10.1089/thy.2015.0227>.
125. Trimboli P, Treglia G, Condorelli E, Romanelli F, Crescenzi A, Bongiovanni M, et al. BRAF-mutated carcinomas among thyroid nodules with prior indeterminate FNA report: a systematic review and meta-analysis. *Clinical endocrinology*. 2016;84:315-320. <https://doi.org/10.1111/cen.12806>.
126. Lee WS, Palmer BJ, Garcia A, Chong VE, Liu TH. BRAF mutation in papillary thyroid cancer: A cost-utility analysis of preoperative testing. *Surgery*. 2014;156:1569-1577; discussion 1577-1568. <https://doi.org/10.1016/j.surg.2014.08.051>.
127. An JH, Song KH, Kim SK, Park KS, Yoo YB, Yang JH, et al. RAS mutations in indeterminate thyroid nodules are predictive of the follicular variant of papillary thyroid carcinoma. *Clinical endocrinology*. 2015;82:760-766. <https://doi.org/10.1111/cen.12579>.
128. Yoon JH, Kwon HJ, Lee HS, Kim EK, Moon HJ, Kwak JY. RAS Mutations in AUS/FLUS Cytology: Does it Have an Additional Role in BRAFV600E Mutation-Negative Nodules? *Medicine*. 2015;94:e1084. <https://doi.org/10.1097/md.0000000000001084>.
129. Marshall CJ, Hall A, Weiss RA. A transforming gene present in human sarcoma cell lines. *Nature*. 1982;299:171-173.
130. Shimizu K, Goldfarb M, Perucho M, Wigler M. Isolation and preliminary characterization of the transforming gene of a human neuroblastoma cell line. *Proc Natl Acad Sci U S A*. 1983;80:383-387.
131. Radkay LA, Chiosea SI, Seethala RR, Hodak SP, LeBeau SO, Yip L, et al. Thyroid nodules with KRAS mutations are different from nodules with NRAS and HRAS mutations with regard to cytopathologic and histopathologic outcome characteristics. *Cancer cytopathology*. 2014;122:873-882. <https://doi.org/10.1002/cncy.21474>.
132. Kunavisarut T. Diagnostic biomarkers of differentiated thyroid cancer. *Endocrine*. 2013;44:616-622. <https://doi.org/10.1007/s12020-013-9974-2>.
133. Mitsutake N, Miyagishi M, Mitsutake S, Akeno N, Mesa C, Jr., Knauf JA, et al. BRAF mediates RET/PTC-induced mitogen-activated protein kinase activation in thyroid cells: functional support for requirement of the RET/PTC-RAS-BRAF pathway in papillary thyroid carcinogenesis. *Endocrinology*. 2006;147:1014-1019. <https://doi.org/10.1210/en.2005-0280>.
134. Guerra A, Sapio MR, Marotta V, Campanile E, Moretti MI, Deandrea M, et al. Prevalence of RET/PTC rearrangement in benign and malignant thyroid nodules and its clinical application. *Endocrine journal*. 2011;58:31-38.
135. Elisei R, Romei C, Vorontsova T, Cosci B, Veremeychik V, Kuchinskaya E, et al. RET/PTC rearrangements in thyroid nodules: studies in irradiated and not irradiated, malignant and benign thyroid lesions in children and adults. *The Journal of clinical endocrinology and metabolism*. 2001;86:3211-3216. <https://doi.org/10.1210/jcem.86.7.7678>.
136. Su X, Li Z, He C, Chen W, Fu X, Yang A. Radiation exposure, young age, and female gender are associated with high prevalence of RET/PTC1 and RET/PTC3 in papillary thyroid cancer: a meta-analysis. *Oncotarget*. 2016;7:16716-16730. <https://doi.org/10.18632/oncotarget.7574>.
137. de Groot JW, Links TP, Plukker JT, Lips CJ, Hofstra RM. RET as a diagnostic and therapeutic target in sporadic and hereditary endocrine tumors. *Endocr Rev*. 2006;27:535-560. <https://doi.org/10.1210/er.2006-0017>.
138. Kroll TG, Sarraf P, Pecciarini L, Chen CJ, Mueller E, Spiegelman BM, et al. PAX8-PPARgamma1 fusion oncogene in human thyroid carcinoma [corrected]. *Science*. 2000;289:1357-1360.
139. Zhang Y, Yu J, Lee C, Xu B, Sartor MA, Koenig RJ. Genomic binding and regulation of gene expression by the thyroid carcinoma-associated PAX8-PPAR fusion protein. *Oncotarget*. 2015;6:40418-40432. <https://doi.org/10.18632/oncotarget.6340>.
140. Pasca di Magliano M, Di Lauro R, Zannini M. Pax8 has a key role in thyroid cell differentiation. *Proc Natl Acad Sci U S A*. 2000;97:13144-13149. <https://doi.org/10.1073/pnas.240336397>.
141. Raman P, Koenig RJ. Pax-8-PPAR-gamma fusion protein in thyroid carcinoma. *Nature reviews Endocrinology*. 2014;10:616-623. <https://doi.org/10.1038/nrendo.2014.115>.
142. Castro P, Rebocho AP, Soares RJ, Magalhaes J, Roque L, Trovisco V, et al. PAX8-PPARgamma rearrangement is frequently detected in the follicular variant of papillary thyroid carcinoma. *The Journal of clinical endocrinology and metabolism*. 2006;91:213-220. <https://doi.org/10.1210/jc.2005-1336>.

143. Nikiforova MN, Lynch RA, Biddinger PW, Alexander EK, Dorn GW, 2nd, Tallini G, et al. RAS point mutations and PAX8-PPAR gamma rearrangement in thyroid tumors: evidence for distinct molecular pathways in thyroid follicular carcinoma. *The Journal of clinical endocrinology and metabolism*. 2003;88:2318-2326. <https://doi.org/10.1210/jc.2002-021907>.
144. Jeong SH, Hong HS, Kwak JJ, Lee EH. Analysis of RAS mutation and PAX8/PPARgamma rearrangements in follicular-derived thyroid neoplasms in a Korean population: frequency and ultrasound findings. *Journal of endocrinological investigation*. 2015;38:849-857. <https://doi.org/10.1007/s40618-015-0311-x>.
145. Armstrong MJ, Yang H, Yip L, Ohori NP, McCoy KL, Stang MT, et al. PAX8/PPARgamma rearrangement in thyroid nodules predicts follicular-pattern carcinomas, in particular the encapsulated follicular variant of papillary carcinoma. *Thyroid*. 2014;24:1369-1374. <https://doi.org/10.1089/thy.2014.0067>.
146. French CA, Alexander EK, Cibas ES, Nose V, Laguette J, Faquin W, et al. Genetic and biological subgroups of low-stage follicular thyroid cancer. *The American journal of pathology*. 2003;162:1053-1060. [https://doi.org/10.1016/S0002-9440\(10\)63902-8](https://doi.org/10.1016/S0002-9440(10)63902-8).
147. French CA, Fletcher JA, Cibas ES, Caulfield C, Allard P, Kroll TG. Molecular detection of PPAR gamma rearrangements and thyroid carcinoma in preoperative fine-needle aspiration biopsies. *Endocrine pathology*. 2008;19:166-174. <https://doi.org/10.1007/s12022-008-9036-0>.
148. Collins K, Mitchell JR. Telomerase in the human organism. *Oncogene*. 2002;21:564-579. <https://doi.org/10.1038/sj.onc.1205083>.
149. Melo M, da Rocha AG, Vinagre J, Batista R, Peixoto J, Tavares C, et al. TERT promoter mutations are a major indicator of poor outcome in differentiated thyroid carcinomas. *The Journal of clinical endocrinology and metabolism*. 2014;99:E754-765. <https://doi.org/10.1210/jc.2013-3734>.
150. Umbricht CB, Conrad GT, Clark DP, Westra WH, Smith DC, Zahurak M, et al. Human telomerase reverse transcriptase gene expression and the surgical management of suspicious thyroid tumors. *Clinical cancer research*. 2004;10:5762-5768. <https://doi.org/10.1158/1078-0432.ccr-03-0389>.
151. Liou MJ, Chan EC, Lin JD, Liu FH, Chao TC. Human telomerase reverse transcriptase (hTERT) gene expression in FNA samples from thyroid neoplasms. *Cancer letters*. 2003;191:223-227.
152. Greco A, Miranda C, Pierotti MA. Rearrangements of NTRK1 gene in papillary thyroid carcinoma. *Mol Cell Endocrinol*. 2010;321:44-49. <https://doi.org/10.1016/j.mce.2009.10.009>.
153. Berlingieri MT, Pierantoni GM, Giancotti V, Santoro M, Fusco A. Thyroid cell transformation requires the expression of the HMGA1 proteins. *Oncogene*. 2002;21:2971-2980. <https://doi.org/10.1038/sj.onc.1205368>.
154. Lappinga PJ, Kip NS, Jin L, Lloyd RV, Henry MR, Zhang J, et al. HMGA2 gene expression analysis performed on cytologic smears to distinguish benign from malignant thyroid nodules. *Cancer cytopathology*. 2010;118:287-297. <https://doi.org/10.1002/cncy.20095>.
155. Bartolazzi A, Gasbarri A, Papotti M, Bussolati G, Lucante T, Khan A, et al. Application of an immunodiagnostic method for improving preoperative diagnosis of nodular thyroid lesions. *Lancet*. 2001;357:1644-1650.
156. Maruta J, Hashimoto H, Yamashita H, Yamashita H, Noguchi S. Immunostaining of galectin-3 and CD44v6 using fine-needle aspiration for distinguishing follicular carcinoma from adenoma. *Diagnostic cytopathology*. 2004;31:392-396. <https://doi.org/10.1002/dc.20156>.
157. Matesa N, Samija I, Kusic Z. Accuracy of fine needle aspiration biopsy with and without the use of tumor markers in cytologically indeterminate thyroid lesions. *Collegium antropologicum*. 2010;34:53-57.
158. Yip L, Farris C, Kabaker AS, Hodak SP, Nikiforova MN, McCoy KL, et al. Cost impact of molecular testing for indeterminate thyroid nodule fine-needle aspiration biopsies. *The Journal of clinical endocrinology and metabolism*. 2012;97:1905-1912. <https://doi.org/10.1210/jc.2011-3048>.
159. Lee L, How J, Tabah RJ, Mitmaker EJ. Cost-effectiveness of molecular testing for thyroid nodules with atypia of undetermined significance cytology. *The Journal of clinical endocrinology and metabolism*. 2014;99:2674-2682. <https://doi.org/10.1210/jc.2014-1219>.
160. Nikiforova MN, Wald AI, Roy S, Durso MB, Nikiforov YE. Targeted next-generation sequencing panel (ThyroSeq) for detection of mutations in thyroid cancer. *The Journal of clinical endocrinology and metabolism*. 2013;98:E1852-1860. <https://doi.org/10.1210/jc.2013-2292>.
161. Nishino M. Molecular cytopathology for thyroid nodules: A review of methodology and test performance. *Cancer cytopathology*. 2016;124:14-27. <https://doi.org/10.1002/cncy.21612>.
162. ThermoFisher Scientific. Ion AmpliSeq™ Cancer Hotspot Panel v2. 2107. <https://www.thermofisher.com/order/catalog/product/4475346>. Accessed 25-03-2017.
163. Chudova D, Wilde JL, Wang ET, Wang H, Rabbee N, Egidio CM, et al. Molecular classification of thyroid nodules using high-dimensionality genomic data. *The Journal of clinical endocrinology and metabolism*. 2010;95:5296-5304. <https://doi.org/10.1210/jc.2010-1087>.

164. Alexander EK, Kennedy GC, Baloch ZW, Cibas ES, Chudova D, Diggans J, et al. Preoperative diagnosis of benign thyroid nodules with indeterminate cytology. *The New England journal of medicine*. 2012;367:705-715. <https://doi.org/10.1056/NEJMoa1203208>.
165. Alexander EK, Schorr M, Klopfer J, Kim C, Sipos J, Nabhan F, et al. Multicenter clinical experience with the Afirma gene expression classifier. *The Journal of clinical endocrinology and metabolism*. 2014;99:119-125. <https://doi.org/10.1210/jc.2013-2482>.
166. Duick DS, Klopfer JP, Diggans JC, Friedman L, Kennedy GC, Lanman RB, et al. The impact of benign gene expression classifier test results on the endocrinologist-patient decision to operate on patients with thyroid nodules with indeterminate fine-needle aspiration cytopathology. *Thyroid*. 2012;22:996-1001. <https://doi.org/10.1089/thy.2012.0180>.
167. Witt RL. Outcome of thyroid gene expression classifier testing in clinical practice. *The Laryngoscope*. 2016;126:524-527. <https://doi.org/10.1002/lary.25607>.
168. McIver B, Castro MR, Morris JC, Bernet V, Smallridge R, Henry M, et al. An independent study of a gene expression classifier (Afirma) in the evaluation of cytologically indeterminate thyroid nodules. *The Journal of clinical endocrinology and metabolism*. 2014;99:4069-4077. <https://doi.org/10.1210/jc.2013-3584>.
169. Yang SE, Sullivan PS, Zhang J, Govind R, Levin MR, Rao JY, et al. Has Afirma gene expression classifier testing refined the indeterminate thyroid category in cytology? *Cancer cytopathology*. 2016;124:100-109. <https://doi.org/10.1002/cncy.21624>.
170. Brauner E, Holmes BJ, Krane JF, Nishino M, Zurakowski D, Hennessey JV, et al. Performance of the Afirma Gene Expression Classifier in Hurthle Cell Thyroid Nodules Differs from Other Indeterminate Thyroid Nodules. *Thyroid*. 2015;25:789-796. <https://doi.org/10.1089/thy.2015.0049>.
171. Celik B, Whetsell CR, Nassar A. Afirma GEC and thyroid lesions: An institutional experience. *Diagnostic cytopathology*. 2015;43:966-970. <https://doi.org/10.1002/dc.23378>.
172. Marti JL, Avadhani V, Donatelli LA, Niyogi S, Wang B, Wong RJ, et al. Wide Inter-institutional Variation in Performance of a Molecular Classifier for Indeterminate Thyroid Nodules. *Annals of surgical oncology*. 2015. <https://doi.org/10.1245/s10434-015-4486-3>.
173. Noureldine SI, Olson MT, Agrawal N, Prescott JD, Zeiger MA, Tufano RP. Effect of Gene Expression Classifier Molecular Testing on the Surgical Decision-Making Process for Patients With Thyroid Nodules. *JAMA otolaryngology - head & neck surgery*. 2015;141:1082-1088. <https://doi.org/10.1001/jamaoto.2015.2708>.
174. Aragon Han P, Olson MT, Fazeli R, Prescott JD, Pai SI, Schneider EB, et al. The impact of molecular testing on the surgical management of patients with thyroid nodules. *Annals of surgical oncology*. 2014;21:1862-1869. <https://doi.org/10.1245/s10434-014-3508-x>.
175. Wu JX, Lam R, Levin M, Rao J, Sullivan PS, Yeh MW. Effect of malignancy rates on cost-effectiveness of routine gene expression classifier testing for indeterminate thyroid nodules. *Surgery*. 2016;159:118-129. <https://doi.org/10.1016/j.surg.2015.05.035>.
176. Li H, Robinson KA, Anton B, Saldanha JJ, Ladenson PW. Cost-effectiveness of a novel molecular test for cytologically indeterminate thyroid nodules. *The Journal of clinical endocrinology and metabolism*. 2011;96:E1719-1726. <https://doi.org/10.1210/jc.2011-0459>.
177. Heinzl A, Muller D, Behrendt FF, Giovannella L, Mottaghy FM, Verburg FA. Thyroid nodules with indeterminate cytology: molecular imaging with (99m)Tc-methoxyisobutylisonitrile (MIBI) is more cost-effective than the Afirma gene expression classifier. *Eur J Nucl Med Mol Imaging*. 2014;41:1497-1500. <https://doi.org/10.1007/s00259-014-2760-4>.
178. Labourier E. Utility and cost-effectiveness of molecular testing in thyroid nodules with indeterminate cytology. *Clinical endocrinology*. 2016;85:624-631. <https://doi.org/10.1111/cen.13096>.
179. Macias AA, Eappen S, Malikin I, Goldfarb J, Kujawa S, Konowitz PM, et al. Successful intraoperative electrophysiologic monitoring of the recurrent laryngeal nerve, a multidisciplinary approach: The Massachusetts Eye and Ear Infirmary monitoring collaborative protocol with experience in over 3000 cases. *Head & neck*. 2016;38:1487-1494. <https://doi.org/10.1002/hed.24468>.
180. Harrell RM, Bimston DN. Surgical utility of Afirma: effects of high cancer prevalence and oncocytic cell types in patients with indeterminate thyroid cytology. *Endocrine practice*. 2014;20:364-369. <https://doi.org/10.4158/ep13330.or>.
181. Santhanam P, Khthir R, Gress T, Elkadry A, Olajide O, Yaqub A, et al. Gene expression classifier for the diagnosis of indeterminate thyroid nodules: a meta-analysis. *Medical oncology*. 2016;33:14. <https://doi.org/10.1007/s12032-015-0727-3>.
182. Lastra RR, Pramick MR, Crammer CJ, LiVolsi VA, Baloch ZW. Implications of a suspicious afirma test result in thyroid fine-needle aspiration cytology: an institutional experience. *Cancer cytopathology*. 2014;122:737-744. <https://doi.org/10.1002/cncy.21455>.
183. He H, Jazdzewski K, Li W, Liyanarachchi S, Nagy R, Volinia S, et al. The role of microRNA genes in papillary thyroid carcinoma. *Proc Natl Acad Sci U S A*. 2005;102:19075-19080. <https://doi.org/10.1073/pnas.0509603102>.
184. Pallante P, Visone R, Ferracin M, Ferraro A, Berlingieri MT, Troncone G, et al. MicroRNA deregulation in human thyroid papillary carcinomas. *Endocrine-related cancer*. 2006;13:497-508. <https://doi.org/10.1677/erc.1.01209>.

185. Nikiforova MN, Nikiforov YE. Molecular diagnostics and predictors in thyroid cancer. *Thyroid*. 2009;19:1351-1361. <https://doi.org/10.1089/thy.2009.0240>.
186. Nikiforova MN, Tseng GC, Steward D, Diorio D, Nikiforov YE. MicroRNA expression profiling of thyroid tumors: biological significance and diagnostic utility. *The Journal of clinical endocrinology and metabolism*. 2008;93:1600-1608. <https://doi.org/10.1210/jc.2007-2696>.
187. Agretti P, Ferrarini E, Rago T, Candelieri A, De Marco G, Dimida A, et al. MicroRNA expression profile helps to distinguish benign nodules from papillary thyroid carcinomas starting from cells of fine-needle aspiration. *European journal of endocrinology*. 2012;167:393-400. <https://doi.org/10.1530/eje-12-0400>.
188. Aragon Han P, Weng CH, Khawaja HT, Nagarajan N, Schneider EB, Umbricht CB, et al. MicroRNA Expression and Association with Clinicopathologic Features in Papillary Thyroid Cancer: A Systematic Review. *Thyroid*. 2015;25:1322-1329. <https://doi.org/10.1089/thy.2015.0193>.
189. Li X, Abdel-Mageed AB, Mondal D, Kandil E. MicroRNA expression profiles in differentiated thyroid cancer, a review. *International journal of clinical and experimental medicine*. 2013;6:74-80.
190. Dettmer M, Perren A, Moch H, Komminoth P, Nikiforov YE, Nikiforova MN. Comprehensive MicroRNA expression profiling identifies novel markers in follicular variant of papillary thyroid carcinoma. *Thyroid*. 2013;23:1383-1389. <https://doi.org/10.1089/thy.2012.0632>.
191. Dettmer M, Voetseder A, Durso MB, Moch H, Komminoth P, Perren A, et al. MicroRNA expression array identifies novel diagnostic markers for conventional and oncocytic follicular thyroid carcinomas. *The Journal of clinical endocrinology and metabolism*. 2013;98:E1-7. <https://doi.org/10.1210/jc.2012-2694>.
192. Shen R, Liyanarachchi S, Li W, Wakely PE, Jr., Saji M, Huang J, et al. MicroRNA signature in thyroid fine needle aspiration cytology applied to "atypia of undetermined significance" cases. *Thyroid*. 2012;22:9-16. <https://doi.org/10.1089/thy.2011.0081>.
193. Weber F, Teresi RE, Broelsch CE, Frilling A, Eng C. A limited set of human MicroRNA is deregulated in follicular thyroid carcinoma. *The Journal of clinical endocrinology and metabolism*. 2006;91:3584-3591. <https://doi.org/10.1210/jc.2006-0693>.
194. Stokowy T, Wojtas B, Fajarewicz K, Jarzab B, Eszlinger M, Paschke R. miRNAs with the potential to distinguish follicular thyroid carcinomas from benign follicular thyroid tumors: results of a meta-analysis. *Hormone and metabolic research*. 2014;46:171-180. <https://doi.org/10.1055/s-0033-1363264>.
195. Zhang Y, Zhong Q, Chen X, Fang J, Huang Z. Diagnostic value of microRNAs in discriminating malignant thyroid nodules from benign ones on fine-needle aspiration samples. *Tumour biology*. 2014;35:9343-9353. <https://doi.org/10.1007/s13277-014-2209-1>.
196. Wei WJ, Shen CT, Song HJ, Qiu ZL, Luo QY. MicroRNAs as a potential tool in the differential diagnosis of thyroid cancer: a systematic review and meta-analysis. *Clinical endocrinology*. 2016;84:127-133. <https://doi.org/10.1111/cen.12696>.
197. Keutgen XM, Filicori F, Crowley MJ, Wang Y, Scognamiglio T, Hoda R, et al. A panel of four miRNAs accurately differentiates malignant from benign indeterminate thyroid lesions on fine needle aspiration. *Clinical cancer research*. 2012;18:2032-2038. <https://doi.org/10.1158/1078-0432.ccr-11-2487>.
198. Vriens MR, Weng J, Suh I, Huynh N, Guerrero MA, Shen WT, et al. MicroRNA expression profiling is a potential diagnostic tool for thyroid cancer. *Cancer*. 2012;118:3426-3432. <https://doi.org/10.1002/cncr.26587>.
199. Rossi ED, Bizzarro T, Martini M, Capodimonti S, Sarti D, Cenci T, et al. The evaluation of miRNAs on thyroid FNAC: the promising role of miR-375 in follicular neoplasms. *Endocrine*. 2016. <https://doi.org/10.1007/s12020-016-0866-0>.
200. Igci YZ, Ozkaya M, Korkmaz H, Bozgeyik E, Bayraktar R, Ulasli M, et al. Expression Levels of miR-30a-5p in Papillary Thyroid Carcinoma: A Comparison Between Serum and Fine Needle Aspiration Biopsy Samples. *Genetic testing and molecular biomarkers*. 2015.
201. de Matos LL, Del Giglio AB, Matsubayashi CO, de Lima Farah M, Del Giglio A, da Silva Pinhal MA. Expression of CK-19, galectin-3 and HBME-1 in the differentiation of thyroid lesions: systematic review and diagnostic meta-analysis. *Diagnostic pathology*. 2012;7:97. <https://doi.org/10.1186/1746-1596-7-97>.
202. Bartolazzi A, Orlandi F, Saggiorato E, Volante M, Arecco F, Rossetto R, et al. Galectin-3-expression analysis in the surgical selection of follicular thyroid nodules with indeterminate fine-needle aspiration cytology: a prospective multicentre study. *The lancet oncology*. 2008;9:543-549. [https://doi.org/10.1016/s1470-2045\(08\)70132-3](https://doi.org/10.1016/s1470-2045(08)70132-3).
203. Zhang L, Krausz T, DeMay RM. A Pilot Study of Galectin-3, HBME-1, and p27 Triple Immunostaining Pattern for Diagnosis of Indeterminate Thyroid Nodules in Cytology With Correlation to Histology. *Applied immunohistochemistry & molecular morphology*. 2015;23:481-490. <https://doi.org/10.1097/pai.000000000000106>.
204. Collet JF, Hurbain I, Prengel C, Utzmann O, Scetbon F, Bernaudin JF, et al. Galectin-3 immunodetection in follicular thyroid neoplasms: a prospective study on fine-needle aspiration samples. *British journal of cancer*. 2005;93:1175-1181. <https://doi.org/10.1038/sj.bjc.6602822>.
205. Coli A, Bigotti G, Parente P, Federico F, Castri F, Massi G. Atypical thyroid nodules express both HBME-1 and Galectin-3, two phenotypic markers of papillary thyroid carcinoma. *Journal of experimental & clinical cancer research : CR*. 2007;26:221-227.

206. Bartolazzi A, Bellotti C, Sciacchitano S. Methodology and technical requirements of the galectin-3 test for the preoperative characterization of thyroid nodules. *Applied immunohistochemistry & molecular morphology*. 2012;20:2-7. <https://doi.org/10.1097/PAL.0b013e31821ee9bb>.
207. Rossi ED, Raffaelli M, Mule A, Miraglia A, Lombardi CP, Vecchio FM, et al. Simultaneous immunohistochemical expression of HBME-1 and galectin-3 differentiates papillary carcinomas from hyperfunctioning lesions of the thyroid. *Histopathology*. 2006;48:795-800. <https://doi.org/10.1111/j.1365-2559.2006.02428.x>.
208. Pennelli G, Mian C, Pelizzo MR, Naccamulli D, Piotto A, Girelli ME, et al. Galectin-3 cytotest in thyroid follicular neoplasia: a prospective, monoinstitutional study. *Acta cytologica*. 2009;53:533-539.
209. Ito Y, Yoshida H, Tomoda C, Miya A, Kobayashi K, Matsuzuka F, et al. Galectin-3 expression in follicular tumours: an immunohistochemical study of its use as a marker of follicular carcinoma. *Pathology*. 2005;37:296-298. <https://doi.org/10.1080/00313020500169545>.
210. Oestreicher-Kedem Y, Halpern M, Roizman P, Hardy B, Sulkes J, Feinmesser R, et al. Diagnostic value of galectin-3 as a marker for malignancy in follicular patterned thyroid lesions. *Head & neck*. 2004;26:960-966. <https://doi.org/10.1002/hed.20087>.
211. Torregrossa L, Faviana P, Camacci T, Materazzi G, Berti P, Minuto M, et al. Galectin-3 is highly expressed in nonencapsulated papillary thyroid carcinoma but weakly expressed in encapsulated type; comparison with Hector Battifora mesothelial cell 1 immunoreactivity. *Human pathology*. 2007;38:1482-1488. <https://doi.org/10.1016/j.humpath.2007.02.013>.
212. Saggiatoro E, De Pompa R, Volante M, Cappia S, Arecco F, Dei Tos AP, et al. Characterization of thyroid 'follicular neoplasms' in fine-needle aspiration cytological specimens using a panel of immunohistochemical markers: a proposal for clinical application. *Endocrine-related cancer*. 2005;12:305-317. <https://doi.org/10.1677/erc.1.00944>.
213. Aiad HA, Kandil MA, Asaad NY, El-Kased AM, El-Goday SF. Galectin-3 immunostaining in cytological and histopathological diagnosis of thyroid lesions. *Journal of the Egyptian National Cancer Institute*. 2008;20:36-46.
214. Asioli S, Maletta F, Pacchioni D, Lupo R, Bussolati G. Cytological detection of papillary thyroid carcinomas by nuclear membrane decoration with emerlin staining. *Virchows Archiv*. 2010;457:43-51. <https://doi.org/10.1007/s00428-010-0910-z>.
215. Raggio E, Camandona M, Solerio D, Martino P, Franchello A, Orlandi F, et al. The diagnostic accuracy of the immunocytochemical markers in the pre-operative evaluation of follicular thyroid lesions. *Journal of endocrinological investigation*. 2010;33:378-381. <https://doi.org/10.3275/6444>.
216. Cheung CC, Ezzat S, Freeman JL, Rosen IB, Asa SL. Immunohistochemical diagnosis of papillary thyroid carcinoma. *Mod Pathol*. 2001;14:338-342. <https://doi.org/10.1038/modpathol.3880312>.
217. Fadda G, Rossi ED, Raffaelli M, Pontecorvi A, Sioletic S, Morassi F, et al. Follicular thyroid neoplasms can be classified as low- and high-risk according to HBME-1 and Galectin-3 expression on liquid-based fine-needle cytology. *European journal of endocrinology*. 2011;165:447-453. <https://doi.org/10.1530/eje-11-0181>.
218. Lacoste-Collin L, d'Aure D, Berard E, Rouquette I, Delisle MB, Courtade-Saidi M. Improvement of the cytological diagnostic accuracy of follicular thyroid lesions by the use of the Ki-67 proliferative index in addition to cytokeratin-19 and HBME-1 immunomarkers: a study of 61 cases of liquid-based FNA cytology with histological controls. *Cytopathology*. 2014;25:160-169. <https://doi.org/10.1111/cyt.12128>.
219. Rossi ED, Raffaelli M, Minimo C, Mule A, Lombardi CP, Vecchio FM, et al. Immunocytochemical evaluation of thyroid neoplasms on thin-layer smears from fine-needle aspiration biopsies. *Cancer*. 2005;105:87-95. <https://doi.org/10.1002/cncr.21026>.
220. Khurana KK, Truong LD, LiVolsi VA, Baloch ZW. Cytokeratin 19 immunolocalization in cell block preparation of thyroid aspirates. An adjunct to fine-needle aspiration diagnosis of papillary thyroid carcinoma. *Archives of pathology & laboratory medicine*. 2003;127:579-583. [https://doi.org/10.1043/0003-9985\(2003\)127<0579:cicbpb>2.0.co;2](https://doi.org/10.1043/0003-9985(2003)127<0579:cicbpb>2.0.co;2).
221. Baloch ZW, Abraham S, Roberts S, LiVolsi VA. Differential expression of cytokeratins in follicular variant of papillary carcinoma: an immunohistochemical study and its diagnostic utility. *Human pathology*. 1999;30:1166-1171.
222. Kjellman P, Wallin G, Hoog A, Auer G, Larsson C, Zedenius J. MIB-1 index in thyroid tumors: a predictor of the clinical course in papillary thyroid carcinoma. *Thyroid*. 2003;13:371-380. <https://doi.org/10.1089/10507250321669866>.
223. Pisani T, Pantellini F, Centanni M, Vecchione A, Giovagnoli MR. Immunocytochemical expression of Ki67 and laminin in Hurthle cell adenomas and carcinomas. *Anticancer research*. 2003;23:3323-3326.
224. Addati T, Achille G, Centrone M, Petroni S, Popescu O, Russo S, et al. TROP-2 expression in papillary thyroid cancer: a preliminary cyto-histological study. *Cytopathology*. 2015. <https://doi.org/10.1111/cyt.12196>.
225. Coban I, Kadir A, Unal TD, Bassulu N, Karpuz V, Dogusoy GB, et al. Emerin expression in well differentiated epithelial lesions of thyroid: implications in papillary thyroid carcinoma diagnosis and predicting malignant behavior. *Pathol Oncol Res*. 2015;21:357-366. <https://doi.org/10.1007/s12253-014-9828-0>.
226. Chandan VS, Faquin WC, Wilbur DC, Khurana KK. The role of immunolocalization of CD57 and GLUT-1 in cell blocks in fine-needle aspiration diagnosis of papillary thyroid carcinoma. *Cancer*. 2006;108:331-336. <https://doi.org/10.1002/cncr.22172>.

227. Troncione G, Volante M, Iaccarino A, Zeppa P, Cozzolino I, Malapelle U, et al. Cyclin D1 and D3 overexpression predicts malignant behavior in thyroid fine-needle aspirates suspicious for Hurthle cell neoplasms. *Cancer*. 2009;117:522-529. <https://doi.org/10.1002/cncr.20050>.
228. Mills LJ, Poller DN, Yiangou C. Galectin-3 is not useful in thyroid FNA. *Cytopathology*. 2005;16:132-138. <https://doi.org/10.1111/j.1365-2303.2005.00213.x>.
229. Brito JP, Gionfriddo MR, Al Nofal A, Boehmer KR, Leppin AL, Reading C, et al. The accuracy of thyroid nodule ultrasound to predict thyroid cancer: systematic review and meta-analysis. *The Journal of clinical endocrinology and metabolism*. 2014;99:1253-1263. <https://doi.org/10.1210/jc.2013-2928>.
230. Remonti LR, Kramer CK, Leitao CB, Pinto LC, Gross JL. Thyroid ultrasound features and risk of carcinoma: a systematic review and meta-analysis of observational studies. *Thyroid*. 2015;25:538-550. <https://doi.org/10.1089/thy.2014.0353>.
231. Jeh SK, Jung SL, Kim BS, Lee YS. Evaluating the degree of conformity of papillary carcinoma and follicular carcinoma to the reported ultrasonographic findings of malignant thyroid tumor. *Korean journal of radiology*. 2007;8:192-197. <https://doi.org/10.3348/kjr.2007.8.3.192>.
232. Lee SH, Baek JS, Lee JY, Lim JA, Cho SY, Lee TH, et al. Predictive factors of malignancy in thyroid nodules with a cytological diagnosis of follicular neoplasm. *Endocrine pathology*. 2013;24:177-183. <https://doi.org/10.1007/s12022-013-9263-x>.
233. Kim DS, Kim JH, Na DG, Park SH, Kim E, Chang KH, et al. Sonographic features of follicular variant papillary thyroid carcinomas in comparison with conventional papillary thyroid carcinomas. *Journal of ultrasound in medicine*. 2009;28:1685-1692.
234. Ozdemir D, Ersoy R, Cuhaci N, Arpaci D, Ersoy EP, Korukluoglu B, et al. Classical and follicular variant papillary thyroid carcinoma: comparison of clinical, ultrasonographical, cytological, and histopathological features in 444 patients. *Endocrine pathology*. 2011;22:58-65. <https://doi.org/10.1007/s12022-011-9160-0>.
235. Brophy C, Stewart J, O'Donovan N, McCarthy J, Murphy M, Sheahan P. Impact of Microcalcifications on Risk of Malignancy in Thyroid Nodules with Indeterminate or Benign Cytology. *Otolaryngology - head and neck surgery*. 2016;154:46-51. <https://doi.org/10.1177/0194599815605326>.
236. Gweon HM, Son EJ, Youk JH, Kim JA. Thyroid nodules with Bethesda system III cytology: can ultrasonography guide the next step? *Annals of surgical oncology*. 2013;20:3083-3088. <https://doi.org/10.1245/s10434-013-2990-x>.
237. Lee KH, Shin JH, Oh YL, Hahn SY. Atypia of undetermined significance in thyroid fine-needle aspiration cytology: prediction of malignancy by US and comparison of methods for further management. *Annals of surgical oncology*. 2014;21:2326-2331. <https://doi.org/10.1245/s10434-014-3568-y>.
238. Pompili G, Tresoldi S, Primolevo A, De Pasquale L, Di Leo G, Cornalba G. Management of thyroid follicular proliferation: an ultrasound-based malignancy score to opt for surgical or conservative treatment. *Ultrasound in medicine & biology*. 2013;39:1350-1355. <https://doi.org/10.1016/j.ultrasmedbio.2013.02.464>.
239. Yoo WS, Choi HS, Cho SW, Moon JH, Kim KW, Park HJ, et al. The role of ultrasound findings in the management of thyroid nodules with atypia or follicular lesions of undetermined significance. *Clinical endocrinology*. 2014;80:735-742. <https://doi.org/10.1111/cen.12348>.
240. Chng CL, Kurzawinski TR, Beale T. Value of sonographic features in predicting malignancy in thyroid nodules diagnosed as follicular neoplasm on cytology. *Clinical endocrinology*. 2014. <https://doi.org/10.1111/cen.12692>.
241. Tutuncu Y, Berker D, Isik S, Akbaba G, Ozuguz U, Kucukler FK, et al. The frequency of malignancy and the relationship between malignancy and ultrasonographic features of thyroid nodules with indeterminate cytology. *Endocrine*. 2014;45:37-45. <https://doi.org/10.1007/s12020-013-9922-1>.
242. Yoon JH, Kwak JY, Kim EK, Moon HJ, Kim MJ, Kim JY, et al. How to approach thyroid nodules with indeterminate cytology. *Annals of surgical oncology*. 2010;17:2147-2155. <https://doi.org/10.1245/s10434-010-0992-5>.
243. Khoncarly SM, Tamarkin SW, McHenry CR. Can ultrasound be used to predict malignancy in patients with a thyroid nodule and an indeterminate fine-needle aspiration biopsy? *Surgery*. 2014;156:967-970. <https://doi.org/10.1016/j.surg.2014.06.043>.
244. Yoon JH, Lee HS, Kim EK, Moon HJ, Kwak JY. A nomogram for predicting malignancy in thyroid nodules diagnosed as atypia of undetermined significance/follicular lesions of undetermined significance on fine needle aspiration. *Surgery*. 2014;155:1006-1013. <https://doi.org/10.1016/j.surg.2013.12.035>.
245. Dutta S, Thaha MA, Smith DM. Do sonographic and cytological features predict malignancy in cytologically indeterminate thyroid nodules? *Annals of the Royal College of Surgeons of England*. 2011;93:361-364. <https://doi.org/10.1308/003588411x580160>.
246. Parikh PP, Allan BJ, Lew JL. Surgeon-performed ultrasound predictors of malignancy in patients with Hurthle cell neoplasms of the thyroid. *The Journal of surgical research*. 2013;184:247-252. <https://doi.org/10.1016/j.jss.2013.03.005>.
247. Batawil N, Alkordy T. Ultrasonographic features associated with malignancy in cytologically indeterminate thyroid nodules. *European journal of surgical oncology*. 2014;40:182-186. <https://doi.org/10.1016/j.ejso.2013.11.015>.

248. Garino F, Deandrea M, Motta M, Mormile A, Ragazzoni F, Palestini N, et al. Diagnostic performance of elastography in cytologically indeterminate thyroid nodules. *Endocrine*. 2015;49:175-183. <https://doi.org/10.1007/s12020-014-0438-0>.
249. Macias CA, Arumugam D, Arlow RL, Eng OS, Lu SE, Javidian P, et al. A risk model to determine surgical treatment in patients with thyroid nodules with indeterminate cytology. *Annals of surgical oncology*. 2015;22:1527-1532. <https://doi.org/10.1245/s10434-014-4190-8>.
250. Turanli S, Pirhan Y, Ozelcik CK, Cetin A. Predictors of malignancy in patients with a thyroid nodule that contains Hurthle cells. *Otolaryngology - head and neck surgery*. 2011;144:514-517. <https://doi.org/10.1177/0194599810394052>.
251. Lippolis PV, Tognini S, Materazzi G, Polini A, Mancini R, Ambrosini CE, et al. Is elastography actually useful in the presurgical selection of thyroid nodules with indeterminate cytology? *The Journal of clinical endocrinology and metabolism*. 2011;96:E1826-1830. <https://doi.org/10.1210/jc.2011-1021>.
252. Kayilioglu SI, Dinc T, Sozen I, Senol K, Katar K, Karabeyoglu M, et al. Thyroid nodules with atypia or follicular lesions of undetermined significance (AUS/FLUS): analysis of variables associated with outcome. *Asian Pacific Journal of cancer prevention*. 2014;15:10307-10311.
253. Cakir B, Ersoy R, Cuhaci FN, Aydin C, Polat B, Kilic M, et al. Elastosonographic strain index in thyroid nodules with atypia of undetermined significance. *Journal of endocrinological investigation*. 2014;37:127-133. <https://doi.org/10.1007/s40618-013-0005-1>.
254. Calo PG, Medas F, Santa Cruz R, Podda F, Erdas E, Pisano G, et al. Follicular nodules (Thy3) of the thyroid: is total thyroidectomy the best option? *BMC surgery*. 2014;14:12. <https://doi.org/10.1186/1471-2482-14-12>.
255. Cantisani V, Maceroni P, D'Andrea V, Patrizi G, Di Segni M, De Vito C, et al. Strain ratio ultrasound elastography increases the accuracy of colour-Doppler ultrasound in the evaluation of Thy-3 nodules. A bi-centre university experience. *European radiology*. 2015. <https://doi.org/10.1007/s00330-015-3956-0>.
256. Rago T, Di Coscio G, Basolo F, Scutari M, Elisei R, Berti P, et al. Combined clinical, thyroid ultrasound and cytological features help to predict thyroid malignancy in follicular and Hürthle cell thyroid lesions: results from a series of 505 consecutive patients. *Clinical endocrinology*. 2007;66:13-20. <https://doi.org/10.1111/j.1365-2265.2006.02677.x>.
257. Cantisani V, Ulisse S, Guitoli E, De Vito C, Caruso R, Mocini R, et al. Q-elastography in the presurgical diagnosis of thyroid nodules with indeterminate cytology. *PloS one*. 2012;7:e50725. <https://doi.org/10.1371/journal.pone.0050725>.
258. Matthey-Gie ML, Walsh SM, O'Neill AC, Lowery A, Evoy D, Gibbons D, et al. Ultrasound predictors of malignancy in indeterminate thyroid nodules. *Irish journal of medical science*. 2014;183:633-637. <https://doi.org/10.1007/s11845-013-1065-0>.
259. Mohey N, Hassan TA, Abdel-Baki S. Role of combined grey scale US and US tissue elastography in differentiating solid thyroid nodules. *Egyptian Journal of Radiology and Nuclear Medicine*. 2013;44:505-512.
260. Rago T, Scutari M, Santini F, Loiacono V, Piaggi P, Di Coscio G, et al. Real-time elastosonography: useful tool for refining the presurgical diagnosis in thyroid nodules with indeterminate or nondiagnostic cytology. *The Journal of clinical endocrinology and metabolism*. 2010;95:5274-5280. <https://doi.org/10.1210/jc.2010-0901>.
261. Lee KH, Shin JH, Ko ES, Hahn SY, Kim JS, Kim JH, et al. Predictive factors of malignancy in patients with cytologically suspicious for Hurthle cell neoplasm of thyroid nodules. *International journal of surgery*. 2013;11:898-902. <https://doi.org/10.1016/j.ijsu.2013.07.010>.
262. Dogan L, Gulcelik MA, Karaman N, Baskan E, Kahraman YS, Aksel B, et al. The contribution of clinical and radiological features to the diagnosis in AUS/FLUS and FN/SFN thyroid nodules. *Acta Medica Mediterranea*. 2016;32:151-155.
263. Moon HG, Jung EJ, Park ST, Ha WS, Choi SK, Hong SC, et al. Role of ultrasonography in predicting malignancy in patients with thyroid nodules. *World journal of surgery*. 2007;31:1410-1416. <https://doi.org/10.1007/s00268-007-9013-7>.
264. Alexander EK, Marqusee E, Orcutt J, Benson CB, Frates MC, Doubilet PM, et al. Thyroid nodule shape and prediction of malignancy. *Thyroid*. 2004;14:953-958. <https://doi.org/10.1089/thy.2004.14.953>.
265. Chin C, Franklin J, Sowerby L, Fung K, Yoo J. Stratification of intermediate-risk fine-needle aspiration biopsies. *Journal of otolaryngology - head & neck surgery*. 2010;39:393-396.
266. Kim DW, Lee EJ, Jung SJ, Ryu JH, Kim YM. Role of sonographic diagnosis in managing Bethesda class III nodules. *AJNR American journal of neuroradiology*. 2011;32:2136-2141. <https://doi.org/10.3174/ajnr.A2686>.
267. Lee MJ, Hong SW, Chung WY, Kwak JY, Kim MJ, Kim EK. Cytological results of ultrasound-guided fine-needle aspiration cytology for thyroid nodules: emphasis on correlation with sonographic findings. *Yonsei medical journal*. 2011;52:838-844. <https://doi.org/10.3349/ymj.2011.52.5.838>.
268. Maia FF, Matos PS, Pavin EJ, Vassallo J, Zantut-Wittmann DE. Value of ultrasound and cytological classification system to predict the malignancy of thyroid nodules with indeterminate cytology. *Endocrine pathology*. 2011;22:66-73. <https://doi.org/10.1007/s12022-011-9159-6>.

269. Norlen O, Popadich A, Kruijff S, Gill AJ, Sarkis LM, Delbridge L, et al. Bethesda III thyroid nodules: the role of ultrasound in clinical decision making. *Annals of surgical oncology*. 2014;21:3528-3533. <https://doi.org/10.1245/s10434-014-3749-8>.
270. Rosario PW, Salles DS, Bessa B, Purisch S. Contribution of scintigraphy and ultrasonography to the prediction of malignancy in thyroid nodules with indeterminate cytology. *Arquivos brasileiros de endocrinologia e metabologia*. 2010;54:56-59.
271. Rosario PW. Thyroid nodules with atypia or follicular lesions of undetermined significance (Bethesda Category III): importance of ultrasonography and cytological subcategory. *Thyroid*. 2014;24:1115-1120. <https://doi.org/10.1089/thy.2013.0650>.
272. Gulcelik NE, Gulcelik MA, Kuru B. Risk of malignancy in patients with follicular neoplasm: predictive value of clinical and ultrasonographic features. *Archives of otolaryngology--head & neck surgery*. 2008;134:1312-1315. <https://doi.org/10.1001/archotol.134.12.1312>.
273. Kamaya A, Lewis GH, Liu Y, Akatsu H, Kong C, Desser TS. Atypia of undetermined significance and follicular lesions of undetermined significance: sonographic assessment for prediction of the final diagnosis. *Journal of ultrasound in medicine*. 2015;34:767-774. <https://doi.org/10.7863/ultra.34.5.767>.
274. Kwak JY, Han KH, Yoon JH, Moon HJ, Son EJ, Park SH, et al. Thyroid imaging reporting and data system for US features of nodules: a step in establishing better stratification of cancer risk. *Radiology*. 2011;260:892-899. <https://doi.org/10.1148/radiol.11110206>.
275. Horvath E, Majlis S, Rossi R, Franco C, Niedmann JP, Castro A, et al. An ultrasonogram reporting system for thyroid nodules stratifying cancer risk for clinical management. *The Journal of clinical endocrinology and metabolism*. 2009;94:1748-1751. <https://doi.org/10.1210/jc.2008-1724>.
276. Maia FF, Matos PS, Pavin EJ, Zantut-Wittmann DE. Thyroid imaging reporting and data system score combined with Bethesda system for malignancy risk stratification in thyroid nodules with indeterminate results on cytology. *Clinical endocrinology*. 2015;82:439-444. <https://doi.org/10.1111/cen.12525>.
277. Park VY, Kim EK, Kwak JY, Yoon JH, Moon HJ. Malignancy risk and characteristics of thyroid nodules with two consecutive results of atypia of undetermined significance or follicular lesion of undetermined significance on cytology. *European radiology*. 2015;25:2601-2607. <https://doi.org/10.1007/s00330-015-3668-5>.
278. Russ G, Royer B, Bigorgne C, Rouxel A, Bienvenu-Perrard M, Leenhardt L. Prospective evaluation of thyroid imaging reporting and data system on 4550 nodules with and without elastography. *European journal of endocrinology*. 2013;168:649-655. <https://doi.org/10.1530/eje-12-0936>.
279. Yoon JH, Kwon HJ, Kim EK, Moon HJ, Kwak JY. Subcategorization of atypia of undetermined significance/follicular lesion of undetermined significance (AUS/FLUS): a study applying Thyroid Imaging Reporting and Data System (TIRADS). *Clinical endocrinology*. 2016. <https://doi.org/10.1111/cen.12987>.
280. Raber W, Kaserer K, Niederle B, Vierhapper H. Risk factors for malignancy of thyroid nodules initially identified as follicular neoplasia by fine-needle aspiration: results of a prospective study of one hundred twenty patients. *Thyroid*. 2000;10:709-712. <https://doi.org/10.1089/10507250050137806>.
281. Lyshchik A, Higashi T, Asato R, Tanaka S, Ito J, Mai JJ, et al. Thyroid gland tumor diagnosis at US elastography. *Radiology*. 2005;237:202-211. <https://doi.org/10.1148/radiol.2363041248>.
282. Itoh A, Ueno E, Tohno E, Kamma H, Takahashi H, Shiina T, et al. Breast disease: clinical application of US elastography for diagnosis. *Radiology*. 2006;239:341-350. <https://doi.org/10.1148/radiol.2391041676>.
283. Rago T, Santini F, Scutari M, Pinchera A, Vitti P. Elastography: new developments in ultrasound for predicting malignancy in thyroid nodules. *The Journal of clinical endocrinology and metabolism*. 2007;92:2917-2922. <https://doi.org/10.1210/jc.2007-0641>.
284. Asteria C, Giovanardi A, Pizzocaro A, Cozzaglio L, Morabito A, Somalvico F, et al. US-elastography in the differential diagnosis of benign and malignant thyroid nodules. *Thyroid*. 2008;18:523-531. <https://doi.org/10.1089/thy.2007.0323>.
285. Veer V, Puttagunta S. The role of elastography in evaluating thyroid nodules: a literature review and meta-analysis. *European archives of oto-rhino-laryngology*. 2015;272:1845-1855. <https://doi.org/10.1007/s00405-014-3155-7>.
286. Nell S, Kist JW, Debray TP, de Keizer B, van Oostenbrugge TJ, Borel Rinkes IH, et al. Qualitative elastography can replace thyroid nodule fine-needle aspiration in patients with soft thyroid nodules. A systematic review and meta-analysis. *European journal of radiology*. 2015;84:652-661. <https://doi.org/10.1016/j.ejrad.2015.01.003>.
287. Abdelrahman SF, Ali FH, El-Sayed Khalil M, El Masry MR. Ultrasound elastography in the diagnostic evaluation of indeterminate thyroid nodule s. *Egyptian Journal of Radiology and Nuclear Medicine*. 2015;46:639-648.
288. Trimboli P, Treglia G, Sadeghi R, Romanelli F, Giovannella L. Reliability of real-time elastography to diagnose thyroid nodules previously read at FNAC as indeterminate: a meta-analysis. *Endocrine*. 2014. <https://doi.org/10.1007/s12020-014-0510-9>.
289. Park SH, Kim SJ, Kim EK, Kim MJ, Son EJ, Kwak JY. Interobserver agreement in assessing the sonographic and elastographic features of malignant thyroid nodules. *AJR American journal of roentgenology*. 2009;193:W416-423. <https://doi.org/10.2214/AJR.09.2541>.

290. Sebag F, Vaillant-Lombard J, Berbis J, Griset V, Henry JF, Petit P, et al. Shear wave elastography: a new ultrasound imaging mode for the differential diagnosis of benign and malignant thyroid nodules. *The Journal of clinical endocrinology and metabolism*. 2010;95:5281-5288. <https://doi.org/10.1210/jc.2010-0766>.
291. Kim DW. Computed tomography features of papillary thyroid carcinomas. *Journal of computer assisted tomography*. 2014;38:936-940. <https://doi.org/10.1097/rct.0000000000000149>.
292. Lee C, Chalmers B, Treister D, Adhya S, Godwin B, Ji L, et al. Thyroid lesions visualized on CT: sonographic and pathologic correlation. *Academic radiology*. 2015;22:203-209. <https://doi.org/10.1016/j.acra.2014.08.007>.
293. 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;44:70-78. <https://doi.org/10.1007/s12020-013-9932-z>.
294. Gharib H, Papini E. Thyroid nodules: clinical importance, assessment, and treatment. *Endocrinology and metabolism clinics of North America*. 2007;36:707-735, vi. <https://doi.org/10.1016/j.ecl.2007.04.009>.
295. Lumachi F, Varotto L, Borsato S, Tregnagli A, Zucchetta P, Marzola MC, et al. Usefulness of 99mTc-pertechnetate scintigraphy and fine-needle aspiration cytology in patients with solitary thyroid nodules and thyroid cancer. *Anticancer research*. 2004;24:2531-2534.
296. 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. *Journal of nuclear medicine*. 2009;50:1785-1793. <https://doi.org/10.2967/jnumed.109.064980>.
297. Vattimo A, Bertelli P, Cintonino M, Burrioni L, Volterrani D, Vella A. Identification of Hurthle cell tumor by single-injection, double-phase scintigraphy with technetium-99m-sestamibi. *Journal of nuclear medicine*. 1995;36:778-782.
298. Boi F, Lai ML, Deias C, Piga M, Serra A, Ucheddu A, et al. The usefulness of 99mTc-SestaMIBI scan in the diagnostic evaluation of thyroid nodules with oncocytic cytology. *European journal of endocrinology*. 2003;149:493-498.
299. Hindie E, Ugur O, Fuster D, O'Doherty M, Grassetto G, Urena P, et al. 2009 EANM parathyroid guidelines. *Eur J Nucl Med Mol Imaging*. 2009;36:1201-1216. <https://doi.org/10.1007/s00259-009-1131-z>.
300. Wale A, Miles KA, Young B, Zammit C, Williams A, Quin J, et al. Combined (99m)Tc-methoxyisobutylisonitrile scintigraphy and fine-needle aspiration cytology offers an accurate and potentially cost-effective investigative strategy for the assessment of solitary or dominant thyroid nodules. *European journal of nuclear medicine and molecular imaging*. 2014;41:105-115. <https://doi.org/10.1007/s00259-013-2546-0>.
301. Madorin CA, Owen R, Coakley B, Lowe H, Nam KH, Weber K, et al. Comparison of radiation exposure and cost between dynamic computed tomography and sestamibi scintigraphy for preoperative localization of parathyroid lesions. *JAMA Surg*. 2013;148:500-503. <https://doi.org/10.1001/jamasurg.2013.57>.
302. Heller M, Zanoocco K, Zydowicz S, Elaraj D, Nayar R, Sturgeon C. Cost-effectiveness analysis of repeat fine-needle aspiration for thyroid biopsies read as atypia of undetermined significance. *Surgery*. 2012;152:423-430. <https://doi.org/10.1016/j.surg.2012.05.038>.
303. Mitchell JC, Grant F, Evenson AR, Parker JA, Hasselgren PO, Parangi S. Preoperative evaluation of thyroid nodules with 18FDG-PET/CT. *Surgery*. 2005;138:1166-1174; discussion 1174-1165. <https://doi.org/10.1016/j.surg.2005.08.031>.
304. 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;117:4582-4594. <https://doi.org/10.1002/cncr.26085>.
305. Kresnik E, Gallowitsch HJ, Mikosch P, Stettner H, Igerc I, Gomez I, et al. Fluorine-18-fluorodeoxyglucose positron emission tomography in the preoperative assessment of thyroid nodules in an endemic goiter area. *Surgery*. 2003;133:294-299. <https://doi.org/10.1067/msy.2003.71>.
306. Sebastianes FM, Cerci JJ, Zanon PH, Soares J, Jr., Chibana LK, Tomimori EK, et al. Role of 18F-fluorodeoxyglucose positron emission tomography in preoperative assessment of cytologically indeterminate thyroid nodules. *The Journal of clinical endocrinology and metabolism*. 2007;92:4485-4488. <https://doi.org/10.1210/jc.2007-1043>.
307. Traugott AL, Dehdashti F, Trinkaus K, Cohen M, Fialkowski E, Quayle F, et al. Exclusion of malignancy in thyroid nodules with indeterminate fine-needle aspiration cytology after negative 18F-fluorodeoxyglucose positron emission tomography: interim analysis. *World journal of surgery*. 2010;34:1247-1253. <https://doi.org/10.1007/s00268-010-0398-3>.
308. Hales NW, Kreml GA, Medina JE. Is there a role for fluorodeoxyglucose positron emission tomography/computed tomography in cytologically indeterminate thyroid nodules? *American journal of otolaryngology*. 2008;29:113-118. <https://doi.org/10.1016/j.amjoto.2007.04.006>.
309. Deandreis D, Al Ghuzlan A, Auperin A, Vielh P, Caillou B, Chami L, et al. Is (18F)-fluorodeoxyglucose-PET/CT useful for the presurgical characterization of thyroid nodules with indeterminate fine needle aspiration cytology? *Thyroid*. 2012;22:165-172. <https://doi.org/10.1089/thy.2011.0255>.

310. Smith RB, Robinson RA, Hoffman HT, Graham MM. Preoperative FDG-PET imaging to assess the malignant potential of follicular neoplasms of the thyroid. *Otolaryngology - head and neck surgery*. 2008;138:101-106. <https://doi.org/10.1016/j.otohns.2007.09.008>.
311. Valderrabano P, Montilla-Soler J, Mifsud M, Leon M, Centeno B, Khazai L, et al. Hypermetabolism on (18) F-Fluorodeoxyglucose Positron Emission Tomography Scan Does Not Influence the Interpretation of Thyroid Cytopathology, and Nodules with a SUVmax <2.5 Are Not at Increased Risk for Malignancy. *Thyroid*. 2016;26:1300-1307. <https://doi.org/10.1089/thy.2015.0654>.
312. Kim JM, Ryu JS, Kim TY, Kim WB, Kwon GY, Gong G, et al. 18F-fluorodeoxyglucose positron emission tomography does not predict malignancy in thyroid nodules cytologically diagnosed as follicular neoplasm. *The Journal of clinical endocrinology and metabolism*. 2007;92:1630-1634. <https://doi.org/10.1210/jc.2006-2311>.
313. Boellaard R, Delgado-Bolton R, Oyen WJ, Giammarile F, Tatsch K, Eschner W, et al. FDG PET/CT: EANM procedure guidelines for tumour imaging: version 2.0. *Eur J Nucl Med Mol Imaging*. 2015;42:328-354. <https://doi.org/10.1007/s00259-014-2961-x>.
314. Vriens D, Visser EP, de Geus-Oei LF, Oyen WJ. Methodological considerations in quantification of oncological FDG PET studies. *Eur J Nucl Med Mol Imaging*. 2010;37:1408-1425. <https://doi.org/10.1007/s00259-009-1306-7>.
315. Pathak KA, Klonisch T, Nason RW, Leslie WD. FDG-PET characteristics of Hurthle cell and follicular adenomas. *Annals of nuclear medicine*. 2016;30:506-509. <https://doi.org/10.1007/s12149-016-1087-6>.
316. Boellaard R, O'Doherty MJ, Weber WA, Mottaghy FM, Lonsdale MN, Stroobants SG, et al. FDG PET and PET/CT: EANM procedure guidelines for tumour PET imaging: version 1.0. *Eur J Nucl Med Mol Imaging*. 2010;37:181-200. <https://doi.org/10.1007/s00259-009-1297-4>.
317. Treglia G, Taralli S, Salsano M, Muoio B, Sadeghi R, Giovanella L. Prevalence and malignancy risk of focal colorectal incidental uptake detected by (18)F-FDG-PET or PET/CT: a meta-analysis. *Radiology and oncology*. 2014;48:99-104. <https://doi.org/10.2478/raon-2013-0035>.
318. Nayan S, Ramakrishna J, Gupta MK. The Proportion of Malignancy in Incidental Thyroid Lesions on 18-FDG PET Study: A Systematic Review and Meta-analysis. *Otolaryngology - head and neck surgery*. 2014;151:190-200. <https://doi.org/10.1177/0194599814530861>.
319. Nakahira M, Saito N, Murata S, Sugawara M, Shimamura Y, Morita K, et al. Quantitative diffusion-weighted magnetic resonance imaging as a powerful adjunct to fine needle aspiration cytology for assessment of thyroid nodules. *American journal of otolaryngology*. 2012;33:408-416. <https://doi.org/10.1016/j.amjoto.2011.10.013>.
320. Brown AM, Nagala S, McLean MA, Lu Y, Scoffings D, Apte A, et al. Multi-institutional validation of a novel textural analysis tool for preoperative stratification of suspected thyroid tumors on diffusion-weighted MRI. *Magnetic resonance in medicine*. 2015. <https://doi.org/10.1002/mrm.25743>.
321. Razeq AA, Sadek AG, Kombar OR, Elmahdy TE, Nada N. Role of apparent diffusion coefficient values in differentiation between malignant and benign solitary thyroid nodules. *AJNR American journal of neuroradiology*. 2008;29:563-568. <https://doi.org/10.3174/ajnr.Ao849>.
322. Chen X, Li WL, Zhang YL, Wu Q, Guo YM, Bai ZL. Meta-analysis of quantitative diffusion-weighted MR imaging in the differential diagnosis of breast lesions. *BMC cancer*. 2010;10:693. <https://doi.org/10.1186/1471-2407-10-693>.
323. Wang J, Takashima S, Takayama F, Kawakami S, Saito A, Matsushita T, et al. Head and neck lesions: characterization with diffusion-weighted echo-planar MR imaging. *Radiology*. 2001;220:621-630. <https://doi.org/10.1148/radiol.2202010063>.
324. Bozgeyik Z, Coskun S, Dagli AF, Ozkan Y, Sahpaz F, Ogur E. Diffusion-weighted MR imaging of thyroid nodules. *Neuroradiology*. 2009;51:193-198. <https://doi.org/10.1007/s00234-008-0494-3>.
325. Dilli A, Ayaz UY, Kadir E, Cakal E, Gultekin SS, Hekimoglu B. The efficacy of apparent diffusion coefficient value calculation in differentiation between malignant and benign thyroid nodules. *Clin Imaging*. 2012;36:316-322. <https://doi.org/10.1016/j.clinimag.2011.10.006>.
326. Erdem G, Erdem T, Muammer H, Mutlu DY, Firat AK, Sahin I, et al. Diffusion-weighted images differentiate benign from malignant thyroid nodules. *Journal of magnetic resonance imaging : JMIR*. 2010;31:94-100. <https://doi.org/10.1002/jmri.22000>.
327. Mutlu H, Sivrioğlu AK, Sonmez G, Velioğlu M, Sildiroğlu HO, Basekim CC, et al. Role of apparent diffusion coefficient values and diffusion-weighted magnetic resonance imaging in differentiation between benign and malignant thyroid nodules. *Clin Imaging*. 2012;36:1-7. <https://doi.org/10.1016/j.clinimag.2011.04.001>.
328. Schueller-Weidekamm C, Kaserer K, Schueller G, Scheuba C, Ringl H, Weber M, et al. Can quantitative diffusion-weighted MR imaging differentiate benign and malignant cold thyroid nodules? Initial results in 25 patients. *AJNR American journal of neuroradiology*. 2009;30:417-422. <https://doi.org/10.3174/ajnr.A1338>.
329. Chen L, Xu J, Bao J, Huang X, Hu X, Xia Y, et al. Diffusion-weighted MRI in differentiating malignant from benign thyroid nodules: a meta-analysis. *BMJ Open*. 2016;6:e008413. <https://doi.org/10.1136/bmjopen-2015-008413>.
330. Friedrich-Rust M, Meyer G, Dauth N, Berner C, Bogdanou D, Herrmann E, et al. Interobserver agreement of Thyroid Imaging Reporting and Data System (TIRADS) and strain elastography for the assessment of thyroid nodules. *PloS one*. 2013;8:e77927. <https://doi.org/10.1371/journal.pone.0077927>.

331. Chou CK, Chen RF, Chou FF, Chang HW, Chen YJ, Lee YF, et al. miR-146b is highly expressed in adult papillary thyroid carcinomas with high risk features including extrathyroidal invasion and the BRAF(V600E) mutation. *Thyroid*. 2010;20:489-494. <https://doi.org/10.1089/thy.2009.0027>.
332. National Cancer Institute. The website of the National Cancer Institute. <https://www.cancer.gov>.
333. Cancer Genome Atlas Research N. Integrated genomic characterization of papillary thyroid carcinoma. *Cell*. 2014;159:676-690. <https://doi.org/10.1016/j.cell.2014.09.050>.
334. Hyman DM, Puzanov I, Subbiah V, Faris JE, Chau I, Blay JY, et al. Vemurafenib in Multiple Nonmelanoma Cancers with BRAF V600 Mutations. *The New England journal of medicine*. 2015;373:726-736. <https://doi.org/10.1056/NEJMoa1502309>.
335. Chapman PB, Hauschild A, Robert C, Haanen JB, Ascierto P, Larkin J, et al. Improved survival with vemurafenib in melanoma with BRAF V600E mutation. *The New England journal of medicine*. 2011;364:2507-2516. <https://doi.org/10.1056/NEJMoa1103782>.
336. Pagan M, Kloos RT, Lin CF, Travers KJ, Matsuzaki H, Tom EY, et al. The diagnostic application of RNA sequencing in patients with thyroid cancer: an analysis of 851 variants and 133 fusions in 524 genes. *BMC Bioinformatics*. 2016;17 Suppl 1:6. <https://doi.org/10.1186/s12859-015-0849-9>.
337. Ciregia F, Giusti L, Molinaro A, Nicolai F, Agretti P, Rago T, et al. Presence in the pre-surgical fine-needle aspiration of potential thyroid biomarkers previously identified in the post-surgical one. *PloS one*. 2013;8:e72911. <https://doi.org/10.1371/journal.pone.0072911>.
338. Pagni F, Mainini V, Garancini M, Bono F, Vanzati A, Giardini V, et al. Proteomics for the diagnosis of thyroid lesions: preliminary report. *Cytopathology*. 2014. <https://doi.org/10.1111/cyt.12166>.
339. Cerutti JM, Oler G, Delcelo R, Gerardt R, Michaluart P, Jr., de Souza SJ, et al. PVALB, a new Hurthle adenoma diagnostic marker identified through gene expression. *The Journal of clinical endocrinology and metabolism*. 2011;96:E151-160. <https://doi.org/10.1210/jc.2010-1318>.
340. Evangelisti C, de Biase D, Kurelac I, Ceccarelli C, Prokisch H, Meitinger T, et al. A mutation screening of oncogenes, tumor suppressor gene TP53 and nuclear encoded mitochondrial complex I genes in oncocyctic thyroid tumors. *BMC cancer*. 2015;15:157. <https://doi.org/10.1186/s12885-015-1122-3>.
341. Finley DJ, Zhu B, Fahey TJ, 3rd. Molecular analysis of Hurthle cell neoplasms by gene profiling. *Surgery*. 2004;136:1160-1168. <https://doi.org/10.1016/j.surg.2004.05.061>.
342. Ganly I, Ricarte Filho J, Eng S, Ghossein R, Morris LG, Liang Y, et al. Genomic dissection of Hurthle cell carcinoma reveals a unique class of thyroid malignancy. *The Journal of clinical endocrinology and metabolism*. 2013;98:E962-972. <https://doi.org/10.1210/jc.2012-3539>.
343. Corver WE, Ruano D, Weijers K, den Hartog WC, van Nieuwenhuizen MP, de Miranda N, et al. Genome haploidisation with chromosome 7 retention in oncocyctic follicular thyroid carcinoma. *PloS one*. 2012;7:e38287. <https://doi.org/10.1371/journal.pone.0038287>.
344. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6:e1000097. <https://doi.org/10.1371/journal.pmed.1000097>.
345. Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig LM, et al. The STARD statement for reporting studies of diagnostic accuracy: explanation and elaboration. *Annals of internal medicine*. 2003;138:W1-12.
346. Whiting PF, Rutjes AW, Westwood ME, Mallett S, Deeks JJ, Reitsma JB, et al. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. *Annals of internal medicine*. 2011;155:529-536. <https://doi.org/10.7326/0003-4819-155-8-201110180-00009>.
347. Dwamena B. MIDAS: Stata module for meta-analytical integration of diagnostic test accuracy studies. *Statistical Software Components S456880*, Boston College Department of Economics. 2007;revised 05 Feb 2009.
348. Harbord RM. metandi: Meta-analysis of diagnostic accuracy using hierarchical logistic regression. *The Stata Journal*. 2009;9:211-229.
349. StataCorp. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP; 2015.
350. Park SJ, Sun JY, Hong K, Kwak JY, Kim EK, Chung WY, et al. Application of BRAF, NRAS, KRAS mutations as markers for the detection of papillary thyroid cancer from FNAB specimens by pyrosequencing analysis. *Clinical chemistry and laboratory medicine*. 2013;51:1673-1680. <https://doi.org/10.1515/cclm-2012-0375>.
351. 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;43:1018-1026. <https://doi.org/10.1007/s00259-015-3285-1>.
352. Trimboli P, Guglielmi R, Monti S, Misischi I, Graziano F, Nasrollah N, et al. Ultrasound sensitivity for thyroid malignancy is increased by real-time elastography: a prospective multicenter study. *The Journal of clinical endocrinology and metabolism*. 2012;97:4524-4530. <https://doi.org/10.1210/jc.2012-2951>.

353. Unluturk U, Erdogan MF, Demir O, Gullu S, Baskal N. Ultrasound elastography is not superior to grayscale ultrasound in predicting malignancy in thyroid nodules. *Thyroid*. 2012;22:1031-1038. <https://doi.org/10.1089/thy.2011.0502>.
354. Kim SK, Lee JH, Woo JW, Park I, Choe JH, Kim JH, et al. Prediction Table and Nomogram as Tools for Diagnosis of Papillary Thyroid Carcinoma: Combined Analysis of Ultrasonography, Fine-Needle Aspiration Biopsy, and BRAF V600E Mutation. *Medicine*. 2015;94:e760. <https://doi.org/10.1097/md.0000000000000760>.
355. Cochand-Priollet B, Dahan H, Laloi-Michelin M, Polivka M, Saada M, Herman P, et al. Immunocytochemistry with cytokeratin 19 and anti-human mesothelial cell antibody (HBME1) increases the diagnostic accuracy of thyroid fine-needle aspirations: preliminary report of 150 liquid-based fine-needle aspirations with histological control. *Thyroid*. 2011;21:1067-1073. <https://doi.org/10.1089/thy.2011.0014>.
356. De Nicola H, Szejnfeld J, Logullo AF, Wolosker AM, Souza LR, Chiferi V, Jr. Flow pattern and vascular resistive index as predictors of malignancy risk in thyroid follicular neoplasms. *Journal of ultrasound in medicine*. 2005;24:897-904.
357. Sippel RS, Elaraj DM, Khanafshar E, Kebebew E, Duh QY, Clark OH. Does the presence of additional thyroid nodules on ultrasound alter the risk of malignancy in patients with a follicular neoplasm of the thyroid? *Surgery*. 2007;142:851-857; discussion 857-851-852. <https://doi.org/10.1016/j.surg.2007.08.011>.
358. De Napoli L, Bakkar S, Ambrosini CE, Materazzi G, Proietti A, Macerola E, et al. Indeterminate Single Thyroid Nodule: Synergistic Impact of Mutational Markers and Sonographic Features in Triaging Patients to Appropriate Surgery. *Thyroid*. 2016. <https://doi.org/10.1089/thy.2015.0311>.
359. Ragazzoni F, Deandrea M, Mormile A, Ramunni MJ, Garino F, Magliona G, et al. High diagnostic accuracy and interobserver reliability of real-time elastography in the evaluation of thyroid nodules. *Ultrasound in medicine & biology*. 2012;38:1154-1162. <https://doi.org/10.1016/j.ultrasmedbio.2012.02.025>.
360. Trimboli P, Nasrollah N, Guidobaldi L, Taccogna S, Ciciarella Modica DD, Amendola S, et al. The use of core needle biopsy as first-line in diagnosis of thyroid nodules reduces false negative and inconclusive data reported by fine-needle aspiration. *World J Surg Oncol*. 2014;12:61. <https://doi.org/10.1186/1477-7819-12-61>.
361. Parmar C, Grossmann P, Bussink J, Lambin P, Aerts HJWL. Machine Learning methods for Quantitative Radiomic Biomarkers. *Sci Rep*. 2015;5:13087. <https://doi.org/10.1038/srep13087>.
362. Gillies RJ, Kinahan PE, Hricak H. Radiomics: Images Are More than Pictures, They Are Data. *Radiology*. 2016;278:563-577. <https://doi.org/10.1148/radiol.2015151169>.
363. Boellaard R, Delgado-Bolton R, Oyen WJG, Giammarile F, Tatsch K, Eschner W, et al. FDG PET/CT: EANM procedure guidelines for tumour imaging: version 2.0. *Eur J Nucl Med Mol Imaging*. 2015;42:328-354.
364. Sieren JP, Newell JD, Jr., Barr RG, Bleeker ER, Burnette N, Carretta EE, et al. SPIROMICS Protocol for Multicenter Quantitative Computed Tomography to Phenotype the Lungs. *Am J Respir Crit Care Med*. 2016;194:794-806. <https://doi.org/10.1164/rccm.201506-1208PP>.
365. Pierpaoli C. Quantitative brain MRI. *Topics in magnetic resonance imaging*. 2010;21:63-63. <https://doi.org/10.1097/RMR.0b013e31821e56f8>.
366. Moon JC, Messroghli DR, Kellman P, Piechnik SK, Robson MD, Ugander M, et al. Myocardial T1 mapping and extracellular volume quantification: a Society for Cardiovascular Magnetic Resonance (SCMR) and CMR Working Group of the European Society of Cardiology consensus statement. *J Cardiovasc Magn Reson*. 2013;15:92. <https://doi.org/10.1186/1532-429X-15-92>.
367. Oelze ML, Mamou J. Review of Quantitative Ultrasound: Envelope Statistics and Backscatter Coefficient Imaging and Contributions to Diagnostic Ultrasound. *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*. 2016;63:336-351. <https://doi.org/10.1109/TUFFC.2015.2513958>.
368. McBee MP, Awan OA, Colucci AT, Ghobadi CW, Kadom N, Kansagra AP, et al. Deep Learning in Radiology. *Acad Radiol*. 2018;25:1472-1480. <https://doi.org/10.1016/j.acra.2018.02.018>.
369. Hosny A, Parmar C, Quackenbush J, Schwartz LH, Aerts H. Artificial intelligence in radiology. *Nat Rev Cancer*. 2018;18:500-510. <https://doi.org/10.1038/s41568-018-0016-5>.
370. Bini F, Pica A, Azzimonti L, Giusti A, Ruinelli L, Marinozzi F, et al. Artificial Intelligence in Thyroid Field-A Comprehensive Review. *Cancers (Basel)*. 2021;13. <https://doi.org/10.3390/cancers13194740>.
371. Peng S, Liu Y, Lv W, Liu L, Zhou Q, Yang H, et al. Deep learning-based artificial intelligence model to assist thyroid nodule diagnosis and management: a multicentre diagnostic study. *Lancet Digit Health*. 2021;3:e250-e259. [https://doi.org/10.1016/S2589-7500\(21\)00041-8](https://doi.org/10.1016/S2589-7500(21)00041-8).
372. Li LR, Du B, Liu HQ, Chen C. Artificial Intelligence for Personalized Medicine in Thyroid Cancer: Current Status and Future Perspectives. *Front Oncol*. 2020;10:604051. <https://doi.org/10.3389/fonc.2020.604051>.
373. Sollini M, Cozzi L, Chiti A, Kirienco M. Texture analysis and machine learning to characterize suspected thyroid nodules and differentiated thyroid cancer: Where do we stand? *European journal of radiology*. 2018;99:1-8. <https://doi.org/10.1016/j.ejrad.2017.12.004>.

374. Kelly CJ, Karthikesalingam A, Suleyman M, Corrado G, King D. Key challenges for delivering clinical impact with artificial intelligence. *BMC Med*. 2019;17:195. <https://doi.org/10.1186/s12916-019-1426-2>.
375. Halford GS, Baker R, McCredden JE, Bain JD. How many variables can humans process? *Psychol Sci*. 2005;16:70-76. <https://doi.org/10.1111/j.0956-7976.2005.00782.x>.
376. Holzinger A, Biemann C, Pattichis CS, Kell DB. What do we need to build explainable AI systems for the medical domain? *arXiv preprint arXiv:09923*. 2017.
377. Morin O, Vallières M, Jochems A, Woodruff HC, Valdes G, Braunstein SE, et al. A Deep Look Into the Future of Quantitative Imaging in Oncology: A Statement of Working Principles and Proposal for Change. *International Journal of Radiation Oncology*Biophysics*Physics*. 2018;102:1074-1082. <https://doi.org/https://doi.org/10.1016/j.ijrobp.2018.08.032>.
378. Buvat I, Orlhac F. The dark side of radiomics: on the paramount importance of publishing negative results. *J Nucl Med*. 2019;60:1543-1544. <https://doi.org/10.2967/jnumed.119.235325>.
379. Lambin P, Rios-Velazquez E, Leijenaar R, Carvalho S, van Stiphout RG, Granton P, et al. Radiomics: extracting more information from medical images using advanced feature analysis. *Eur J Cancer*. 2012;48:441-446. <https://doi.org/10.1016/j.ejca.2011.11.036>.
380. Noortman WA, Vriens D, Grootjans W, Tao Q, de Geus-Oei LF, Van Velden FH. Nuclear medicine radiomics in precision medicine: why we can't do without artificial intelligence. *Q J Nucl Med Mol Imaging*. 2020;64:278-290. <https://doi.org/10.23736/s1824-4785.20.03263-x>.
381. Zanfardino M, Franzese M, Pane K, Cavaliere C, Monti S, Esposito G, et al. Bringing radiomics into a multi-omics framework for a comprehensive genotype-phenotype characterization of oncological diseases. *J Transl Med*. 2019;17:337. <https://doi.org/10.1186/s12967-019-2073-2>.
382. Cook GJR, Azad G, Owczarczyk K, Siddique M, Goh V. Challenges and Promises of PET Radiomics. *Int J Radiat Oncol Biol Phys*. 2018;102:1083-1089. <https://doi.org/10.1016/j.ijrobp.2017.12.268>.
383. Zwanenburg A, Leger S, Vallieres M, Lock S. Image biomarker standardisation initiative - feature definitions v11. *CoRR*. 2019;1612.07003.
384. Frings V, van Velden FHP, Velasquez LM, Hayes W, P.M. vdV, O.S. H, et al. Repeatability of Metabolically Active Tumor Volume Measurements with FDG PET/CT in Advanced Gastrointestinal Malignancies: A Multicenter Study. *Radiology*. 2014;273:539-548.
385. van Velden FH, Kramer GM, Frings V, Nissen IA, Mulder ER, de Langen AJ, et al. Repeatability of Radiomic Features in Non-Small-Cell Lung Cancer [(18)F]FDG-PET/CT Studies: Impact of Reconstruction and Delineation. *Mol Imaging Biol*. 2016;18:788-795.
386. Traverso A, Wee L, Dekker A, Gillies R. Repeatability and Reproducibility of Radiomic Features: A Systematic Review. *International Journal of Radiation Oncology*Biophysics*Physics*. 2018;102:1143-1158. <https://doi.org/https://doi.org/10.1016/j.ijrobp.2018.05.053>.
387. O'Connor JP, Aboagye EO, Adams JE, Aerts HJ, Barrington SF, Beer AJ, et al. Imaging biomarker roadmap for cancer studies. *Nat Rev Clin Oncol*. 2017;14:169-186. <https://doi.org/10.1038/nrclinonc.2016.162>.
388. Clarke R, Ressom HW, Wang A, Xuan J, Liu MC, Gehan EA, et al. The properties of high-dimensional data spaces: implications for exploring gene and protein expression data. *Nat Rev Cancer*. 2008;8:37-49. <https://doi.org/10.1038/nrc2294>.
389. Ang JC, Mirzal A, Haron H, Hamed HNA. Supervised, Unsupervised, and Semi-Supervised Feature Selection: A Review on Gene Selection. *IEEE/ACM Trans Comput Biol Bioinform*. 2016;13:971-989. <https://doi.org/10.1109/TCBB.2015.2478454>.
390. Forghani R, Savadjiev P, Chatterjee A, Muthukrishnan N, Reinhold C, Forghani B. Radiomics and Artificial Intelligence for Biomarker and Prediction Model Development in Oncology. *Comput Struct Biotechnol J*. 2019;17:995-1008. <https://doi.org/10.1016/j.csbj.2019.07.001>.
391. Lambin P, Leijenaar RTH, Deist TM, Peerlings J, de Jong EEC, van Timmeren J, et al. Radiomics: the bridge between medical imaging and personalized medicine. *Nat Rev Clin Oncol*. 2017;14:749-762. <https://doi.org/10.1038/nrclinonc.2017.141>.
392. Orlhac F, Nioche C, Klyuzhin I, Rahmim A, Buvat I. Radiomics in PET Imaging: A Practical Guide for Newcomers. *PET Clin*. 2021;16:597-612. <https://doi.org/10.1016/j.cpet.2021.06.007>.
393. Tomaszewski MR, Gillies RJ. The Biological Meaning of Radiomic Features. *Radiology*. 2021;298:505-516. <https://doi.org/10.1148/radiol.202102553>.
394. Tessler FN, Middleton WD, Grant EG, Hoang JK, Berland LL, Teefey SA, et al. ACR Thyroid Imaging, Reporting and Data System (TI-RADS): White Paper of the ACR TI-RADS Committee. *J Am Coll Radiol*. 2017;14:587-595. <https://doi.org/10.1016/j.jacr.2017.01.046>.
395. Russ G, Bonnema SJ, Erdogan MF, Durante C, Ngu R, Leenhardt L. European Thyroid Association Guidelines for Ultrasound Malignancy Risk Stratification of Thyroid Nodules in Adults: The EU-TIRADS. *Eur Thyroid J*. 2017;6:225-237. <https://doi.org/10.1159/000478927>.

396. Shin JH, Baek JH, Chung J, Ha EJ, Kim JH, Lee YH, et al. Ultrasonography Diagnosis and Imaging-Based Management of Thyroid Nodules: Revised Korean Society of Thyroid Radiology Consensus Statement and Recommendations. *Korean journal of radiology*. 2016;17:370-395. <https://doi.org/10.3348/kjr.2016.17.3.370>.
397. Gharib H, Papini E, Garber JR, Duick DS, Harrell RM, Hegedus L, et al. American Association of Clinical Endocrinologists, American College of Endocrinology, and Associazione Medici Endocrinologi Medical Guidelines for Clinical Practice for the Diagnosis and Management of Thyroid Nodules - 2016 Update Appendix. *Endocr Pract*. 2016;22:1-60. <https://doi.org/https://doi.org/10.4158/EP161208.GL>.
398. Hoang JK, Asadollahi S, Durante C, Hegedüs L, Papini E, Tessler FN. An International Survey on Utilization of Five Thyroid Nodule Risk Stratification Systems: A Needs Assessment with Future Implications. *Thyroid*. 2022;32:675-681. <https://doi.org/10.1089/thy.2021.0558>.
399. Grani G, Lamartina L, Ascoli V, Bosco D, Biffoni M, Giacomelli L, et al. Reducing the Number of Unnecessary Thyroid Biopsies While Improving Diagnostic Accuracy: Toward the "Right" TIRADS. *The Journal of clinical endocrinology and metabolism*. 2019;104:95-102. <https://doi.org/10.1210/jc.2018-01674>.
400. Larcher de Almeida AM, Delfim RLC, Vidal APA, Chaves M, Santiago ACL, Gianotti MF, et al. Combining the American Thyroid Association's Ultrasound Classification with Cytological Subcategorization Improves the Assessment of Malignancy Risk in Indeterminate Thyroid Nodules. *Thyroid*. 2021;31:922-932. <https://doi.org/10.1089/thy.2019.0575>.
401. Staibano P, Forner D, Noel CW, Zhang H, Gupta M, Monteiro E, et al. Ultrasonography and Fine-Needle Aspiration in Indeterminate Thyroid Nodules: A Systematic Review of Diagnostic Test Accuracy. *Laryngoscope*. 2022;132:242-251. <https://doi.org/10.1002/lary.29778>.
402. Słowińska-Klencka D, Wysocka-Konieczna K, Klencki M, Popowicz B. Usability of EU-TIRADS in the Diagnostics of Hürthle Cell Thyroid Nodules with Equivocal Cytology. *Journal of clinical medicine*. 2020;9. <https://doi.org/10.3390/jcm9113410>.
403. Barbosa TLM, Junior COM, Graf H, Cavalvanti T, Trippia MA, da Silveira Ugino RT, et al. ACR TI-RADS and ATA US scores are helpful for the management of thyroid nodules with indeterminate cytology. *BMC Endocr Disord*. 2019;19:112. <https://doi.org/10.1186/s12902-019-0429-5>.
404. Wildman-Tobriner B, Buda M, Hoang JK, Middleton WD, Thayer D, Short RG, et al. Using Artificial Intelligence to Revise ACR TI-RADS Risk Stratification of Thyroid Nodules: Diagnostic Accuracy and Utility. *Radiology*. 2019;292:112-119. <https://doi.org/10.1148/radiol.2019182128>.
405. Yoon J, Lee E, Kang SW, Han K, Park VY, Kwak JY. Implications of US radiomics signature for predicting malignancy in thyroid nodules with indeterminate cytology. *Eur Radiol*. 2021;31:5059-5067. <https://doi.org/10.1007/s00330-020-07670-3>.
406. Wallis D, Buvat J. Clever Hans effect found in a widely used brain tumour MRI dataset. *Med Image Anal*. 2022;77:102368. <https://doi.org/10.1016/j.media.2022.102368>.
407. Cleere EF, Davey MG, O'Neill S, Corbett M, O'Donnell JP, Hacking S, et al. Radiomic Detection of Malignancy within Thyroid Nodules Using Ultrasonography—A Systematic Review and Meta-Analysis. 2022;12:794.
408. Duron L, Savatovsky J, Fournier L, Lecler A. Can we use radiomics in ultrasound imaging? Impact of preprocessing on feature repeatability. *Diagn Interv Imaging*. 2021;102:659-667. <https://doi.org/https://doi.org/10.1016/j.diii.2021.10.004>.
409. Dighe MK. Elastography of Thyroid Masses. *Ultrasound Clin*. 2014;9:13-24. <https://doi.org/10.1016/j.cult.2013.08.001>.
410. Bhatia KS, Tong CS, Cho CC, Yuen EH, Lee YY, Ahuja AT. Shear wave elastography of thyroid nodules in routine clinical practice: preliminary observations and utility for detecting malignancy. *Eur Radiol*. 2012;22:2397-2406. <https://doi.org/10.1007/s00330-012-2495-1>.
411. Qiu Y, Xing Z, Liu J, Peng Y, Zhu J, Su A. Diagnostic reliability of elastography in thyroid nodules reported as indeterminate at prior fine-needle aspiration cytology (FNAC): a systematic review and Bayesian meta-analysis. *European radiology*. 2020;30:6624-6634. <https://doi.org/10.1007/s00330-020-07023-0>.
412. Padovani RP, Kasamatsu TS, Nakabashi CC, Camacho CP, Andreoni DM, Malouf EZ, et al. One month is sufficient for urinary iodine to return to its baseline value after the use of water-soluble iodinated contrast agents in post-thyroidectomy patients requiring radioiodine therapy. *Thyroid*. 2012;22:926-930. <https://doi.org/10.1089/thy.2012.0099>.
413. Lee C, Chalmers B, Treister D, Adhya S, Godwin B, Ji L, et al. Thyroid Lesions Visualized on CT: Sonographic and Pathologic Correlation. *Acad Radiol*. 2015;22:203-209. <https://doi.org/https://doi.org/10.1016/j.acra.2014.08.007>.
414. Kim DW. Computed Tomography Features of Papillary Thyroid Carcinomas. 2014;38:936-940. <https://doi.org/10.1097/rct.000000000000149>.
415. Peng W, Liu C, Xia S, Shao D, Chen Y, Liu R, et al. Thyroid nodule recognition in computed tomography using first order statistics. *Biomed Eng Online*. 2017;16:67. <https://doi.org/10.1186/s12938-017-0367-2>.
416. Li W, Cheng S, Qian K, Yue K, Liu H. Automatic Recognition and Classification System of Thyroid Nodules in CT Images Based on CNN. *Comput Intell Neurosci*. 2021;2021:5540186. <https://doi.org/10.1155/2021/5540186>.

417. Russ G, Lebouleux S, Leenhardt L, Hegedüs L. Thyroid incidentalomas: epidemiology, risk stratification with ultrasound and workup. *European thyroid journal*. 2014;3:154-163. <https://doi.org/10.1159/000365289>.
418. McRobbie DW, Moore EA, Graves MJ, Prince MR. MRI from Picture to Proton. 2 ed. Cambridge: Cambridge University Press; 2006.
419. Shi R, Yao Q, Wu L, Zhou Q, Lu Q, Gao R, et al. T2* mapping at 3.0T MRI for differentiation of papillary thyroid carcinoma from benign thyroid nodules. 2016;43:956-961. <https://doi.org/https://doi.org/10.1002/jmri.25041>.
420. Ben-David E, Sadeghi N, Rezaei MK, Muradyan N, Brown D, Joshi A, et al. Semiquantitative and Quantitative Analyses of Dynamic Contrast-Enhanced Magnetic Resonance Imaging of Thyroid Nodules. *J Comput Assist Tomogr*. 2015;39:855-859. <https://doi.org/10.1097/rct.0000000000000304>.
421. Sakat MS, Sade R, Kilic K, Gözeler MS, Pala O, Polat G, et al. The Use of Dynamic Contrast-Enhanced Perfusion MRI in Differentiating Benign and Malignant Thyroid Nodules. *Indian journal of otolaryngology and head and neck surgery*. 2019;71:706-711. <https://doi.org/10.1007/s12070-018-1512-3>.
422. Chung SR, Lee JH, Yoon RK, Sung TY, Song DE, Pfeuffer J, et al. Differentiation of follicular carcinomas from adenomas using histogram obtained from diffusion-weighted MRI. *Clin Radiol*. 2020;75:878.e813-878.e819. <https://doi.org/10.1016/j.crad.2020.07.018>.
423. Wu LM, Chen XX, Li YL, Hua J, Chen J, Hu J, et al. On the utility of quantitative diffusion-weighted MR imaging as a tool in differentiation between malignant and benign thyroid nodules. *Academic radiology*. 2014;21:355-363. <https://doi.org/10.1016/j.acra.2013.10.008>.
424. van der Graaf M. In vivo magnetic resonance spectroscopy: basic methodology and clinical applications. *European biophysics journal*. 2010;39:527-540. <https://doi.org/10.1007/s00249-009-0517-y>.
425. Minuto MN, Shintu L, Caldarelli S. Proteomics, and metabolomics: magnetic resonance spectroscopy for the presurgical screening of thyroid nodules. *Curr Genomics*. 2014;15:178-183. <https://doi.org/10.2174/1389202915999140404100701>.
426. Jordan KW, Adkins CB, Cheng LL, Faquin WC. Application of magnetic-resonance-spectroscopy- based metabolomics to the fine-needle aspiration diagnosis of papillary thyroid carcinoma. *Acta Cytol*. 2011;55:584-589. <https://doi.org/10.1159/000333271>.
427. Lean CL, Delbridge L, Russell P, May GL, Mackinnon WB, Roman S, et al. Diagnosis of follicular thyroid lesions by proton magnetic resonance on fine needle biopsy. *J Clin Endocrinol Metab*. 1995;80:1306-1311. <https://doi.org/10.1210/jcem.80.4.7714105>.
428. Mackinnon WB, Delbridge L, Russell P, Lean CL, May GL, Doran S, et al. Two-dimensional proton magnetic resonance spectroscopy for tissue characterization of thyroid neoplasms. *World J Surg*. 1996;20:841-847. <https://doi.org/10.1007/s002689900128>.
429. Russell P, Lean CL, Delbridge L, May GL, Dowd S, Mountford CE. Proton magnetic resonance and human thyroid neoplasia. I: Discrimination between benign and malignant neoplasms. *Am J Med*. 1994;96:383-388. [https://doi.org/10.1016/0002-9343\(94\)90071-x](https://doi.org/10.1016/0002-9343(94)90071-x).
430. King AD, Yeung DKW, Ahuja AT, Tse GMK, Chan ABW, Lam SSL, et al. In vivo 1H MR spectroscopy of thyroid carcinoma. *Eur J Radiol*. 2005;54:112-117. <https://doi.org/https://doi.org/10.1016/j.ejrad.2004.05.003>.
431. Gupta N, Kakar AK, Chowdhury V, Gulati P, Shankar LR, Vindal A. Magnetic resonance spectroscopy as a diagnostic modality for carcinoma thyroid. *Eur J Radiol*. 2007;64:414-418. <https://doi.org/10.1016/j.ejrad.2007.03.006>.
432. Gupta N, Goswami B, Chowdhury V, RaviShankar L, Kakar A. Evaluation of the Role of Magnetic Resonance Spectroscopy in the Diagnosis of Follicular Malignancies of Thyroid. *Arch Surg*. 2011;146:179-182. <https://doi.org/10.1001/archsurg.2010.345>.
433. Aghaghazvini L, Pirouzi P, Sharifian H, Yazdani N, Kooraki S, Ghadiri A, et al. 3T magnetic resonance spectroscopy as a powerful diagnostic modality for assessment of thyroid nodules. *Archives of endocrinology and metabolism*. 2018;62:501-505. <https://doi.org/10.20945/2359-3997000000069>.
434. Cecil KM. Proton magnetic resonance spectroscopy: technique for the neuroradiologist. *Neuroimaging Clin N Am*. 2013;23:381-392. <https://doi.org/10.1016/j.nic.2012.10.003>.
435. Aydin H, Kizilgoz V, Tatar I, Damar C, Guzel H, Hekimoglu B, et al. The role of proton MR spectroscopy and apparent diffusion coefficient values in the diagnosis of malignant thyroid nodules: preliminary results. *Clin Imaging*. 2012;36:323-333. <https://doi.org/10.1016/j.clinimag.2011.09.009>.
436. Sasaki M, Sumi M, Kaneko K, Ishimaru K, Takahashi H, Nakamura T. Multiparametric MR imaging for differentiating between benign and malignant thyroid nodules: initial experience in 23 patients. *J Magn Reson Imaging*. 2013;38:64-71. <https://doi.org/10.1002/jmri.23948>.
437. Noda Y, Kanematsu M, Goshima S, Kondo H, Watanabe H, Kawada H, et al. MRI of the thyroid for differential diagnosis of benign thyroid nodules and papillary carcinomas. *AJR American journal of roentgenology*. 2015;204:W332-335. <https://doi.org/10.2214/ajr.14.13344>.

438. Liu R, Jiang G, Gao P, Li G, Nie L, Yan J, et al. Non-invasive Amide Proton Transfer Imaging and ZOOM Diffusion-Weighted Imaging in Differentiating Benign and Malignant Thyroid Micronodules. *Front Endocrinol.* 2018;9:747. <https://doi.org/10.3389/fendo.2018.00747>.
439. Wang H, Wei R, Liu W, Chen Y, Song B. Diagnostic efficacy of multiple MRI parameters in differentiating benign vs. malignant thyroid nodules. *BMC Med Imaging.* 2018;18:50. <https://doi.org/10.1186/s12880-018-0294-0>.
440. Song M, Yue Y, Guo J, Zuo L, Peng H, Chan Q, et al. Quantitative analyses of the correlation between dynamic contrast-enhanced MRI and intravoxel incoherent motion DWI in thyroid nodules. *Am J Transl Res.* 2020;12:3984-3992.
441. Wang H, Song B, Ye N, Ren J, Sun X, Dai Z, et al. Machine learning-based multiparametric MRI radiomics for predicting the aggressiveness of papillary thyroid carcinoma. *Eur J Radiol.* 2020;122:108755. <https://doi.org/10.1016/j.ejrad.2019.108755>.
442. Wei R, Wang H, Wang L, Hu W, Sun X, Dai Z, et al. Radiomics based on multiparametric MRI for extrathyroidal extension feature prediction in papillary thyroid cancer. *BMC Med Imaging.* 2021;21:20. <https://doi.org/10.1186/s12880-021-00553-z>.
443. Saggiorato E, Angusti T, Rosas R, Martinese M, Finessi M, Arecco F, et al. ^{99m}Tc-MIBI Imaging in the Presurgical Characterization of Thyroid Follicular Neoplasms: Relationship to Multidrug Resistance Protein Expression. 2009;50:1785-1793. <https://doi.org/10.2967/jnumed.109.064980>.
444. Piccardo A, Puntoni M, Treglia G, Foppiani L, Bertagna F, Paparo F, et al. Thyroid nodules with indeterminate cytology: prospective comparison between 18F-FDG-PET/CT, multiparametric neck ultrasonography, ^{99m}Tc-MIBI scintigraphy and histology. *Eur J Endocrinol.* 2016;174:693-703. <https://doi.org/10.1530/eje-15-1199>.
445. Armefti S, Mettler J, Schmidt M, Faust M, Engels M, Schultheis AM, et al. Could Negative Tc-99m-Methoxyisobutylisonitrile (MIBI) Scintigraphy Obviate the Need for Surgery for Bethesda III and IV Thyroid Nodules? 2021;2:260-267.
446. Campenni A, Siracusa M, Ruggeri RM, Laudicella R, Pignata SA, Baldari S, et al. Differentiating malignant from benign thyroid nodules with indeterminate cytology by (99m)Tc-MIBI scan: a new quantitative method for improving diagnostic accuracy. *Sci Rep.* 2017;7:6147. <https://doi.org/10.1038/s41598-017-06603-3>.
447. Schenke SA, Campenni A, Tuncel M, Bottoni G, Sager S, Bogovic Crncic T, et al. Diagnostic Performance of (99m)Tc-Methoxy-Isobutyl-Isonitrile (MIBI) for Risk Stratification of Hypofunctioning Thyroid Nodules: A European Multicenter Study. *Diagnostics (Basel, Switzerland).* 2022;12. <https://doi.org/10.3390/diagnostics12061358>.
448. Heinzel A, Müller D, Behrendt FF, Giovanella L, Mottaghy FM, Verburg FA. Thyroid nodules with indeterminate cytology: molecular imaging with ^{99m}Tc-methoxyisobutylisonitrile (MIBI) is more cost-effective than the Afirma gene expression classifier. *Eur J Nucl Med Mol Imaging.* 2014;41:1497-1500. <https://doi.org/10.1007/s00259-014-2760-4>.
449. Hindié E, Ugur O, Fuster D, O'Doherty M, Grassetto G, Ureña P, et al. 2009 EANM parathyroid guidelines. *Eur J Nucl Med Mol Imaging.* 2009;36:1201-1216. <https://doi.org/10.1007/s00259-009-1131-z>.
450. Bertagna F, Treglia G, Piccardo A, Giubbini R. Diagnostic and clinical significance of F-18-FDG-PET/CT thyroid incidentalomas. *The Journal of clinical endocrinology and metabolism.* 2012;97:3866-3875. <https://doi.org/10.1210/jc.2012-2390>.
451. de Leijer JF, Metman MJH, van der Hoorn A, Brouwers AH, Kruijff S, van Hemel BM, et al. Focal Thyroid Incidentalomas on (18)F-FDG PET/CT: A Systematic Review and Meta-Analysis on Prevalence, Risk of Malignancy and Inconclusive Fine Needle Aspiration. *Frontiers in endocrinology.* 2021;12:723394. <https://doi.org/10.3389/fendo.2021.723394>.
452. Muñoz Pérez N, Villar del Moral JM, Muros Fuentes MA, López de la Torre M, Arcelus Martínez JJ, Becerra Massare P, et al. Could 18F-FDG-PET/CT avoid unnecessary thyroidectomies in patients with cytological diagnosis of follicular neoplasm? *Langenbeck's Archives of Surgery.* 2013;398:709-716. <https://doi.org/10.1007/s00423-013-1070-9>.
453. Kresnik E, Gallowitsch HJ, Mikosch P, Stettner H, Igerc I, Gomez I, et al. Fluorine-18-fluorodeoxyglucose positron emission tomography in the preoperative assessment of thyroid nodules in an endemic goiter area. *Surgery.* 2003;133:294-299. <https://doi.org/https://doi.org/10.1067/msy.2003.71>.
454. de Koster EJ, de Geus-Oei LF, Brouwers AH, van Dam E, Dijkhorst-Oei LT, van Engen-van Grunsven ACH, et al. [(18)F]FDG-PET/CT to prevent futile surgery in indeterminate thyroid nodules: a blinded, randomised controlled multicentre trial. *Eur J Nucl Med Mol Imaging.* 2022. <https://doi.org/10.1007/s00259-021-05627-2>.
455. de Koster EJ, Noortman WA, Mostert JM, Booi J, Brouwer CB, de Keizer B, et al. Quantitative classification and radiomics of [(18)F]FDG-PET/CT in indeterminate thyroid nodules. *Eur J Nucl Med Mol Imaging.* 2022;49:2174-2188. <https://doi.org/10.1007/s00259-022-05712-0>.
456. Rosario PW, Rocha TG, Calsolari MR. Fluorine-18-fluorodeoxyglucose positron emission tomography in thyroid nodules with indeterminate cytology: a prospective study. *Nucl Med Commun.* 2019;40:185-187. <https://doi.org/10.1097/mnm.0000000000000946>.
457. Pathak KA, Goertzen AL, Nason RW, Klonisch T, Leslie WD. A prospective cohort study to assess the role of FDG-PET in differentiating benign and malignant follicular neoplasms. *Annals of Medicine and Surgery.* 2016;12:27-31. <https://doi.org/https://doi.org/10.1016/j.amsu.2016.10.008>.

458. Merten MM, Castro MR, Zhang J, Durski J, Ryder M. Examining the Role of Preoperative Positron Emission Tomography/Computerized Tomography in Combination with Ultrasonography in Discriminating Benign from Malignant Cytologically Indeterminate Thyroid Nodules. *Thyroid*. 2016;27:95-102. <https://doi.org/10.1089/thy.2016.0379>.
459. Giovannella L, Milan L, Piccardo A, Bottoni G, Cuzzocrea M, Paone G, et al. Radiomics analysis improves (18)FDG PET/CT-based risk stratification of cytologically indeterminate thyroid nodules. *Endocrine*. 2022;75:202-210. <https://doi.org/10.1007/s12020-021-02856-1>.
460. de Koster EJ, Vriens D, van Aken MO, Dijkhorst-Oei LT, Oyen WJG, Peeters RP, et al. FDG-PET/CT in indeterminate thyroid nodules: cost-utility analysis alongside a randomised controlled trial. *Eur J Nucl Med Mol Imaging*. 2022. <https://doi.org/10.1007/s00259-022-05794-w>.
461. de Koster EJ, Husson O, van Dam EWC, Mijnhout GS, Netea-Maier RT, Oyen WJG, et al. Health-related quality of life following FDG-PET/CT for cytological indeterminate thyroid nodules %J *Endocrine Connections*. 2022;11:e220014. <https://doi.org/10.1530/ec-22-0014>.
462. Trimboli P, Piccardo A, Alevizaki M, Virili C, Naseri M, Sola S, et al. Dedicated neck (18) F-FDG PET/CT: An additional tool for risk assessment in thyroid nodules at ultrasound intermediate risk. *Clinical endocrinology*. 2019;90:737-743. <https://doi.org/10.1111/cen.13949>.
463. National Cancer Institute. Surveillance, Epidemiology, and End Results (SEER) Program. CancerStat Facts: Thyroid Cancer. 2020. <https://seer.cancer.gov/statfacts/html/thyro.html>. Accessed 7 July 2021.
464. Durante C, Grani G, Lamartina L, Filetti S, Mandel SJ, Cooper DS. The Diagnosis and Management of Thyroid Nodules: A Review. *JAMA*. 2018;319:914-924. <https://doi.org/10.1001/jama.2018.0898>.
465. 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;117:4582-4594. <https://doi.org/10.1002/cncr.26085>.
466. Rosato L, Avenia N, Bernante P, De Palma M, Gulino G, Nasi PG, et al. Complications of thyroid surgery: analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years. *World journal of surgery*. 2004;28:271-276. <https://doi.org/10.1007/s00268-003-6903-1>.
467. Evidence Based Nation-wide Guideline Thyroid Carcinoma version 2.0. 2015. <https://richtlijnendatabase.nl/richtlijn/schildkliercarcinoom/>. Accessed 7 Jul 2023.
468. Boellaard R, Delgado-Bolton R, Oyen WJ, Giammarile F, Tatsch K, Eschner W, et al. FDG PET/CT: EANM procedure guidelines for tumour imaging: version 2.0. *Eur J Nucl Med Mol Imaging*. 2015;42:328-354. <https://doi.org/10.1007/s00259-014-2961-x>.
469. Giovannella L, Avram AM, Iakovou I, Kwak J, Lawson SA, Lulaj E, et al. EANM practice guideline/SNMMI procedure standard for RAIU and thyroid scintigraphy. *Eur J Nucl Med Mol Imaging*. 2019;46:2514-2525. <https://doi.org/10.1007/s00259-019-04472-8>.
470. EQ-5D-5L User Guide. 2019. <https://euroqol.org/publications/user-guides>. Accessed 7 Jul 2021.
471. Herdman M, Gudex C, Lloyd A, Janssen M, Kind P, Parkin D, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Quality of life research*. 2011;20:1727-1736. <https://doi.org/10.1007/s11136-011-9903-x>.
472. Bouwmans C, Krol M, Severens H, Koopmanschap M, Brouwer W, Hakkaart-van Roijen L. The iMTA Productivity Cost Questionnaire: A Standardized Instrument for Measuring and Valuing Health-Related Productivity Losses. *Value in health*. 2015;18:753-758. <https://doi.org/10.1016/j.jval.2015.05.009>.
473. iMTA Productivity and Health Research Group. Manual iMTA Medical Cost Questionnaire (iMCQ). <https://www.imta.nl/>. Accessed 7 Jul 2021.
474. Versteegh MM, Vermeulen KM, Evers SMAA, de Wit GA, Prenger R, Stolk EA. Dutch Tariff for the Five-Level Version of EQ-5D. *Value in health*. 2016;19:343-352. <https://doi.org/10.1016/j.jval.2016.01.003>.
475. Stiggelbout AM, Eijkemans MJ, Kiebert GM, Kievit J, Leer JW, De Haes HJ. The 'utility' of the visual analog scale in medical decision making and technology assessment. Is it an alternative to the time trade-off? *International journal of technology assessment in health care*. 1996;12:291-298. <https://doi.org/10.1017/s0266462300009648>.
476. Dutch Healthcare Authority (NZA). Open data of the Dutch Healthcare Authority (NZA). 2020. <https://opendisdata.nl/>. Accessed 24 Aug 2021.
477. Hakkaart-van Roijen L, Van der Linden N, Bouwmans CAM, Kanters TA, Tan SS. Costing manual: Methodology of costing research and reference prices for economic evaluations in healthcare [in Dutch: Kostenhandleiding: Methodologie van kostenonderzoek en referentieprijs voor economische evaluaties in de gezondheidszorg]. Rotterdam, the Netherlands; 2015.
478. Dutch Consumer Price index. <https://opendata.cbs.nl/statline/#/CBS/nl/>. Accessed 14 Apr 2021.

479. Kahan BC, Morris TP. Reporting and analysis of trials using stratified randomisation in leading medical journals: review and reanalysis. *Bmj*. 2012;345:e5840. <https://doi.org/10.1136/bmj.e5840>.
480. Pathak KA, Klonisch T, Nason RW, Leslie WD. FDG-PET characteristics of Hurthle cell and follicular adenomas. *Annals of nuclear medicine*. 2016;30:506-509. <https://doi.org/10.1007/s12149-016-1087-6>.
481. Ceriani L, Milan L, Virili C, Cascione L, Paone G, Trimboli P, et al. Radiomics Analysis of [(18)F]-Fluorodeoxyglucose-Avid Thyroid Incidentalomas Improves Risk Stratification and Selection for Clinical Assessment. *Thyroid*. 2021;31:88-95. <https://doi.org/10.1089/thy.2020.0224>.
482. Giovannella L, Milan L, Piccardo A, Bottoni G, Cuzzocrea M, Paone G, et al. Radiomics analysis improves (18)FDG PET/CT-based risk stratification of cytologically indeterminate thyroid nodules. *Endocrine*. 2021. <https://doi.org/10.1007/s12020-021-02856-1>.
483. Gopal RK, Kubler K, Calvo SE, Polak P, Livitz D, Rosebrock D, et al. Widespread Chromosomal Losses and Mitochondrial DNA Alterations as Genetic Drivers in Hurthle Cell Carcinoma. *Cancer Cell*. 2018;34:242-255. <https://doi.org/10.1016/j.ccell.2018.06.013>.
484. Doerfler WR, Nikitski AV, Morariu EM, Ohori NP, Chiosea SI, Landau MS, et al. Molecular alterations in Hurthle cell nodules and preoperative cancer risk. *Endocrine-related cancer*. 2021;28:301-309. <https://doi.org/10.1530/ERC-20-0435>.
485. Rosario PW, Rocha TG, Calsolari MR. Fluorine-18-fluorodeoxyglucose positron emission tomography in thyroid nodules with indeterminate cytology: a prospective study. *Nuclear medicine communications*. 2019;40:185-187. <https://doi.org/10.1097/MNM.0000000000000946>.
486. Qichang W, Jinming S, Lu L, Bin J, Renjie W, Xiuying Z. Comparison of 18F-FDG-PET and 18F-FDG-PET/CT for the diagnostic performance in thyroid nodules with indeterminate cytology: A meta-analysis. *Medicine*. 2020;99:1-9. <https://doi.org/10.1097/MD.00000000000020446>.
487. Kaida H, Hiromatsu Y, Kurata S, Kawahara A, Hattori S, Taira T, et al. Relationship between clinicopathological factors and fluorine-18-fluorodeoxyglucose uptake in patients with papillary thyroid cancer. *Nuclear medicine communications*. 2011;32:690-698. <https://doi.org/10.1097/MNM.0b013e32834754f1>.
488. Staibano P, Forner D, Noel CW, Zhang H, Gupta M, Monteiro E, et al. Ultrasonography and Fine-Needle Aspiration in Indeterminate Thyroid Nodules: A Systematic Review of Diagnostic Test Accuracy. *The Laryngoscope*. 2021. <https://doi.org/10.1002/lary.29778>.
489. Yip L, Sosa JA. Molecular-Directed Treatment of Differentiated Thyroid Cancer: Advances in Diagnosis and Treatment. *JAMA Surg*. 2016;151:663-670. <https://doi.org/10.1001/jamasurg.2016.0825>.
490. Steward DL, Carty SE, Sippel RS, Yang SP, Sosa JA, Sipos JA, et al. Performance of a Multigene Genomic Classifier in Thyroid Nodules With Indeterminate Cytology: A Prospective Blinded Multicenter Study. *JAMA Oncol*. 2019;5:204-212. <https://doi.org/10.1001/jamaoncol.2018.4616>.
491. Angell TE, Heller HT, Cibas ES, Barletta JA, Kim MI, Krane JF, et al. Independent Comparison of the Afirma Genomic Sequencing Classifier and Gene Expression Classifier for Cytologically Indeterminate Thyroid Nodules. *Thyroid*. 2019;29:650-656. <https://doi.org/10.1089/thy.2018.0726>.
492. Eszlinger M, Bohme K, Ullmann M, Gorke F, Siebolts U, Neumann A, et al. Evaluation of a Two-Year Routine Application of Molecular Testing of Thyroid Fine-Needle Aspirations Using a Seven-Gene Panel in a Primary Referral Setting in Germany. *Thyroid*. 2017;27:402-411. <https://doi.org/10.1089/thy.2016.0445>.
493. Bardet S, Goardon N, Lequesne J, Vaur D, Ciappuccini R, Leconte A, et al. Diagnostic and prognostic value of a 7-panel mutation testing in thyroid nodules with indeterminate cytology: the SWEETMAC study. *Endocrine*. 2021;71:407-417. <https://doi.org/10.1007/s12020-020-02411-4>.
494. Paschke R, Cantara S, Crescenzi A, Jarzab B, Musholt TJ, Sobrinho Simoes M. European Thyroid Association Guidelines regarding Thyroid Nodule Molecular Fine-Needle Aspiration Cytology Diagnostics. *Eur Thyroid J*. 2017;6:115-129. <https://doi.org/10.1159/000468519>.
495. Balentine CJ, Vanness DJ, Schneider DF. Cost-effectiveness of lobectomy versus genetic testing (Afirma(R)) for indeterminate thyroid nodules: Considering the costs of surveillance. *Surgery*. 2018;163:88-96. <https://doi.org/10.1016/j.surg.2017.10.004>.
496. Nicholson KJ, Roberts MS, McCoy KL, Carty SE, Yip L. Molecular Testing Versus Diagnostic Lobectomy in Bethesda III/IV Thyroid Nodules: A Cost-Effectiveness Analysis. *Thyroid*. 2019;29:1237-1243. <https://doi.org/10.1089/thy.2018.0779>.
497. Endo M, Porter K, Long C, Azaryan I, Phay JE, Ringel MD, et al. Features of Cytologically Indeterminate Molecularly Benign Nodules Treated With Surgery. *The Journal of clinical endocrinology and metabolism*. 2020;105:e3971-3980. <https://doi.org/10.1210/clinem/dgaa506>.
498. Wang H, Dai H, Li Q, Shen G, Shi L, Tian R. Investigating (18)F-FDG PET/CT Parameters as Prognostic Markers for Differentiated Thyroid Cancer: A Systematic Review. *Front Oncol*. 2021;11:648658. <https://doi.org/10.3389/fonc.2021.648658>.

499. Choi JW, Yoon YH, Yoon YH, Kim SM, Koo BS. Characteristics of primary papillary thyroid carcinoma with false-negative findings on initial (18)F-FDG PET/CT. *Annals of surgical oncology*. 2011;18:1306-1311. <https://doi.org/10.1245/s10434-010-1469-2>.
500. Bongiovanni M, Spitale A, Faquin WC, Mazzucchelli L, Baloch ZW. The Bethesda System for Reporting Thyroid Cytopathology: a meta-analysis. *Acta cytologica*. 2012;56:333–339. <https://doi.org/10.1159/000339959>.
501. de Koster EJ, de Geus-Oei LF, Brouwers AH, van Dam E, Dijkhorst-Oei LT, van Engen-van Grunsven ACH, et al. [(18)F]FDG-PET/CT to prevent futile surgery in indeterminate thyroid nodules: a blinded, randomised controlled multicentre trial. *Eur J Nucl Med Mol Imaging*. 2022;49:1970-1984. <https://doi.org/10.1007/s00259-021-05627-2>.
502. Nguyen TT, Lange NGE, Nielsen AL, Thomassen A, Dossing H, Godballe C, et al. PET/CT and prediction of thyroid cancer in patients with follicular neoplasm or atypia. *European archives of oto-rhino-laryngology*. 2018;275:2109-2117. <https://doi.org/10.1007/s00405-018-5030-4>.
503. Wong KS, Angell TE, Barletta JA, Krane JF. Hurthle cell lesions of the thyroid: Progress made and challenges remaining. *Cancer cytopathology*. 2021;129:347-362. <https://doi.org/10.1002/cncy.22375>.
504. Zhou X, Zheng Z, Chen C, Zhao B, Cao H, Li T, et al. Clinical characteristics and prognostic factors of Hurthle cell carcinoma: a population based study. *BMC cancer*. 2020;20:407. <https://doi.org/10.1186/s12885-020-06915-0>.
505. Limkin EJ, Sun R, Dercle L, Zacharakis EI, Robert C, Reuze S, et al. Promises and challenges for the implementation of computational medical imaging (radiomics) in oncology. *Ann Oncol*. 2017;28:1191-1206. <https://doi.org/10.1093/annonc/mdx034>.
506. Gillies RJ, Kinahan PE, Hricak H. Radiomics: Images Are More than Pictures, They Are Data. *Radiology*. 2016;278:563-577. <https://doi.org/10.1148/radiol.201551169>.
507. Sollini M, Cozzi L, Pepe G, Antunovic L, Lania A, Di Tommaso L, et al. [(18)F]FDG-PET/CT texture analysis in thyroid incidentalomas: preliminary results. *Eur J Hybrid Imaging*. 2017;1:3. <https://doi.org/10.1186/s41824-017-0009-8>.
508. Aksu A, Karahan Sen NP, Acar E, Capa Kaya G. Evaluating Focal (18)F-FDG Uptake in Thyroid Gland with Radiomics. *Nuclear medicine and molecular imaging*. 2020;54:241-248. <https://doi.org/10.1007/s13139-020-00659-2>.
509. Kim SJ, Chang S. Predictive value of intratumoral heterogeneity of F-18 FDG uptake for characterization of thyroid nodules according to Bethesda categories of fine needle aspiration biopsy results. *Endocrine*. 2015;50:681-688. <https://doi.org/10.1007/s12020-015-0620-z>.
510. Wahl RL, Jacene H, Kasamon Y, Lodge MA. From RECIST to PERCIST: Evolving Considerations for PET response criteria in solid tumors. *Journal of nuclear medicine*. 2009;50 Suppl 1:122S-150S. <https://doi.org/10.2967/jnumed.108.057307>.
511. Frings V, van Velden FH, Velasquez LM, Hayes W, van de Ven PM, Hoekstra OS, et al. Repeatability of metabolically active tumor volume measurements with FDG PET/CT in advanced gastrointestinal malignancies: a multicenter study. *Radiology*. 2014;273:539-548. <https://doi.org/10.1148/radiol.14132807>.
512. Kikinis R, Pieper SD, Vosburgh KG. 3D Slicer: A Platform for Subject-Specific Image Analysis, Visualization, and Clinical Support. In: Jolesz F, editor. *Intraoperative Imaging and Image-Guided Therapy*. New York, NY, USA: Springer; 2014. p. 277-289.
513. van Griethuysen JJM, Fedorov A, Parmar C, Hosny A, Aucoin N, Narayan V, et al. Computational Radiomics System to Decode the Radiographic Phenotype. *Cancer Res*. 2017;77:e104-e107. <https://doi.org/10.1158/0008-5472.CAN-17-0339>.
514. Zwanenburg A, Leger S, Vallières M, Löck S. Image biomarker standardisation initiative. *arXiv*. 2019;1612.07003.
515. Peeters CFW, Übelhör C, Mes SW, Martens RM, Koopman T, Graaf Pd, et al. Stable prediction with radiomics data. *ArXiv*. 2019;abs/1903.11696.
516. Bouckaert RR, Frank E. *Evaluating the Replicability of Significance Tests for Comparing Learning Algorithms*. Berlin, Heidelberg: Springer Berlin Heidelberg; 2004. p. 3-12.
517. Orlhac F, Nioche C, Klyuzhin I, Rahmim A, Buvat I. Radiomics in PET Imaging:: A Practical Guide for Newcomers. *PET Clin*. 2021;16:597-612. <https://doi.org/10.1016/j.cpet.2021.06.007>.
518. Collins GS, Reitsma JB, Altman DG, Moons KG. Transparent reporting of a multivariable prediction model for individual prognosis or diagnosis (TRIPOD): the TRIPOD statement. *BMJ*. 2015;350:g7594. <https://doi.org/10.1136/bmj.g7594>.
519. Slowinska-Klencka D, Wysocka-Konieczna K, Klencki M, Popowicz B. Usability of EU-TIRADS in the Diagnostics of Hurthle Cell Thyroid Nodules with Equivocal Cytology. *J Clin Med*. 2020;9. <https://doi.org/10.3390/jcm9113410>.
520. Pathak KA, Goertzen AL, Nason RW, Klonisch T, Leslie WD. A prospective cohort study to assess the role of FDG-PET in differentiating benign and malignant follicular neoplasms. *Ann Med Surg (Lond)*. 2016;12:27-31. <https://doi.org/10.1016/j.amsu.2016.10.008>.
521. Nie F, Xu D, Tsang IW, Zhang C. Flexible manifold embedding: a framework for semi-supervised and unsupervised dimension reduction. *IEEE Trans Image Process*. 2010;19:1921-1932. <https://doi.org/10.1109/TIP.2010.2044958>.

522. Pfaehler E, van Sluis J, Merema BBJ, van Ooijen P, Berendsen RCM, van Velden FHP, et al. Experimental Multicenter and Multivendor Evaluation of the Performance of PET Radiomic Features Using 3-Dimensionally Printed Phantom Inserts. *Journal of nuclear medicine*. 2020;61:469-476. <https://doi.org/10.2967/jnumed.119.229724>.
523. Zwanenburg A, Vallières M, Abdalah MA, Aerts HJWL, Andrearczyk V, Apte A, et al. The Image Biomarker Standardization Initiative: Standardized Quantitative Radiomics for High-Throughput Image-based Phenotyping. *Radiology*. 2020;191145. <https://doi.org/10.1148/radiol.2020191145>.
524. Orhac F, Boughdad S, Philippe C, Stalla-Bourdillon H, Nioche C, Champion L, et al. A Postreconstruction Harmonization Method for Multicenter Radiomic Studies in PET. *Journal of nuclear medicine*. 2018;59:1321-1328. <https://doi.org/10.2967/jnumed.117.199935>.
525. Aydemirli MD, Snel M, van Wezel T, Ruano D, Obbink CMH, van den Hout WB, et al. Yield and costs of molecular diagnostics on thyroid cytology slides in the Netherlands, adapting the Bethesda classification. *Endocrinol Diabetes Metab*. 2021;4:e00293. <https://doi.org/10.1002/edm2.293>.
526. Husson O, Haak HR, Oranje WA, Mols F, Reemst PH, van de Poll-Franse LV. Health-related quality of life among thyroid cancer survivors: a systematic review. *Clinical endocrinology*. 2011;75:544-554. <https://doi.org/10.1111/j.1365-2265.2011.04114.x>.
527. Statistics Netherlands. CBS Life tables and survival analyses. 2021. <https://www.cbs.nl>.
528. Lee S, Skelton TS, Zheng F, Schwartz KA, Perrier ND, Lee JE, et al. The biopsy-proven benign thyroid nodule: is long-term follow-up necessary? *Journal of the American College of Surgeons*. 2013;217:81-88; discussion 88-89. <https://doi.org/10.1016/j.jamcollsurg.2013.03.014>.
529. Ajmal S, Rapoport S, Ramirez Batlle H, Mazzaglia PJ. The natural history of the benign thyroid nodule: what is the appropriate follow-up strategy? *Journal of the American College of Surgeons*. 2015;220:987-992. <https://doi.org/10.1016/j.jamcollsurg.2014.12.010>.
530. Nou E, Kwong N, Alexander LK, Cibas ES, Marqusee E, Alexander EK. Determination of the optimal time interval for repeat evaluation after a benign thyroid nodule aspiration. *The Journal of clinical endocrinology and metabolism*. 2014;99:510-516. <https://doi.org/10.1210/jc.2013-3160>.
531. Singh Ospina N, Maraka S, Espinosa de Ycaza AE, Brito JP, Castro MR, Morris JC, et al. Prognosis of patients with benign thyroid nodules: a population-based study. *Endocrine*. 2016;54:148-155. <https://doi.org/10.1007/s12020-016-0967-9>.
532. Durante C, Costante G, Lucisano G, Bruno R, Meringolo D, Paciaroni A, et al. The natural history of benign thyroid nodules. *JAMA*. 2015;313:926-935. <https://doi.org/10.1001/jama.2015.0956>.
533. Lopez-Penabad L, Chiu AC, Hoff AO, Schultz P, Gaztambide S, Ordóñez NG, et al. Prognostic factors in patients with Hurthle cell neoplasms of the thyroid. *Cancer*. 2003;97:1186-1194. <https://doi.org/10.1002/cncr.11176>.
534. Matsuzaki K, Sugino K, Masudo K, Nagahama M, Kitagawa W, Shibuya H, et al. Thyroid lobectomy for papillary thyroid cancer: long-term follow-up study of 1,088 cases. *World journal of surgery*. 2014;38:68-79. <https://doi.org/10.1007/s00268-013-2224-1>.
535. Nixon IJ, Ganly I, Patel SG, Palmer FL, Whitcher MM, Tuttle RM, et al. Thyroid lobectomy for treatment of well differentiated intrathyroid malignancy. *Surgery*. 2012;151:571-579. <https://doi.org/10.1016/j.surg.2011.08.016>.
536. Sugino K, Kameyama K, Ito K, Nagahama M, Kitagawa W, Shibuya H, et al. Outcomes and prognostic factors of 251 patients with minimally invasive follicular thyroid carcinoma. *Thyroid*. 2012;22:798-804. <https://doi.org/10.1089/thy.2012.0051>.
537. Thompson LD, Wieneke JA, Paal E, Frommelt RA, Adair CF, Heffess CS. A clinicopathologic study of minimally invasive follicular carcinoma of the thyroid gland with a review of the English literature. *Cancer*. 2001;91:505-524. [https://doi.org/10.1002/1097-0142\(20010201\)91:3<505::aid-cncr10293>3.0.co;2-6](https://doi.org/10.1002/1097-0142(20010201)91:3<505::aid-cncr10293>3.0.co;2-6).
538. D'Avanzo A, Treseler P, Ituarte PH, Wong M, Streja L, Greenspan FS, et al. Follicular thyroid carcinoma: histology and prognosis. *Cancer*. 2004;100:1123-1129. <https://doi.org/10.1002/cncr.20081>.
539. Bilimoria KY, Bentrem DJ, Ko CY, Stewart AK, Winchester DP, Talamonti MS, et al. Extent of surgery affects survival for papillary thyroid cancer. *Annals of surgery*. 2007;246:375-381; discussion 381-374. <https://doi.org/10.1097/SLA.0b013e31814697d9>.
540. Bojoga A, Koot A, Bonenkamp J, de Wilt J, Int'Hout J, Stalmeier P, et al. The Impact of the Extent of Surgery on the Long-Term Outcomes of Patients with Low-Risk Differentiated Non-Medullary Thyroid Cancer: A Systematic Meta-Analysis. *J Clin Med*. 2020;9. <https://doi.org/10.3390/jcm9072316>.
541. Chan S, Karamali K, Kolodziejczyk A, Oikonomou G, Watkinson J, Paleri V, et al. Systematic Review of Recurrence Rate after Hemithyroidectomy for Low-Risk Well-Differentiated Thyroid Cancer. *Eur Thyroid J*. 2020;9:73-84. <https://doi.org/10.1159/000504961>.
542. Mazzaferri EL, Jhiang SM. Long-term impact of initial surgical and medical therapy on papillary and follicular thyroid cancer. *The American journal of medicine*. 1994;97:418-428. [https://doi.org/10.1016/0002-9343\(94\)90321-2](https://doi.org/10.1016/0002-9343(94)90321-2).

543. Kushchayeva Y, Duh QY, Kebebew E, D'Avanzo A, Clark OH. Comparison of clinical characteristics at diagnosis and during follow-up in 118 patients with Hurthle cell or follicular thyroid cancer. *Am J Surg.* 2008;195:457-462. <https://doi.org/10.1016/j.amjsurg.2007.06.001>.
544. Oluic B, Paunovic I, Loncar Z, Djukic V, Diklic A, Jovanovic M, et al. Survival and prognostic factors for survival, cancer specific survival and disease free interval in 239 patients with Hurthle cell carcinoma: a single center experience. *BMC cancer.* 2017;17:371. <https://doi.org/10.1186/s12885-017-3370-x>.
545. Castagna MG, Maino F, Cipri C, Belardini V, Theodoropoulou A, Cevenini G, et al. Delayed risk stratification, to include the response to initial treatment (surgery and radioiodine ablation), has better outcome predictivity in differentiated thyroid cancer patients. *European journal of endocrinology.* 2011;165:441-446. <https://doi.org/10.1530/EJE-11-0466>.
546. Pitoia F, Jerkovich F, Urciuoli C, Schmidt A, Abelleira E, Bueno F, et al. Implementing the Modified 2009 American Thyroid Association Risk Stratification System in Thyroid Cancer Patients with Low and Intermediate Risk of Recurrence. *Thyroid.* 2015;25:1235-1242. <https://doi.org/10.1089/thy.2015.0121>.
547. Tuttle RM, Tala H, Shah J, Leboeuf R, Ghossein R, Gonen M, et al. Estimating risk of recurrence in differentiated thyroid cancer after total thyroidectomy and radioactive iodine remnant ablation: using response to therapy variables to modify the initial risk estimates predicted by the new American Thyroid Association staging system. *Thyroid.* 2010;20:1341-1349. <https://doi.org/10.1089/thy.2010.0178>.
548. Vaisman F, Momesso D, Bulzico DA, Pessoa CH, Dias F, Corbo R, et al. Spontaneous remission in thyroid cancer patients after biochemical incomplete response to initial therapy. *Clinical endocrinology.* 2012;77:132-138. <https://doi.org/10.1111/j.1365-2265.2012.04342.x>.
549. Goffredo P, Cheung K, Roman SA, Sosa JA. Can minimally invasive follicular thyroid cancer be approached as a benign lesion?: a population-level analysis of survival among 1,200 patients. *Annals of surgical oncology.* 2013;20:767-772. <https://doi.org/10.1245/s10434-012-2697-4>.
550. Adam MA, Pura J, Gu L, Dinan MA, Tyler DS, Reed SD, et al. Extent of surgery for papillary thyroid cancer is not associated with survival: an analysis of 61,775 patients. *Annals of surgery.* 2014;260:601-605; discussion 605-607. <https://doi.org/10.1097/SLA.0000000000000925>.
551. Hundahl SA, Cady B, Cunningham MP, Mazzaferri E, McKee RF, Rosai J, et al. Initial results from a prospective cohort study of 5583 cases of thyroid carcinoma treated in the united states during 1996. U.S. and German Thyroid Cancer Study Group. An American College of Surgeons Commission on Cancer Patient Care Evaluation study. *Cancer.* 2000;89:202-217. [https://doi.org/10.1002/1097-0142\(20000701\)89:1<202::aid-cnrcr273>3.0.co;2-a](https://doi.org/10.1002/1097-0142(20000701)89:1<202::aid-cnrcr273>3.0.co;2-a).
552. Bergenfelz A, Jansson S, Kristoffersson A, Martensson H, Reihner E, Wallin G, et al. Complications to thyroid surgery: results as reported in a database from a multicenter audit comprising 3,660 patients. *Langenbeck's archives of surgery.* 2008;393:667-673. <https://doi.org/10.1007/s00423-008-0366-7>.
553. Elfenbein DM, Schneider DF, Chen H, Sippel RS. Surgical site infection after thyroidectomy: a rare but significant complication. *The Journal of surgical research.* 2014;190:170-176. <https://doi.org/10.1016/j.jss.2014.03.033>.
554. Sheahan P, O'Connor A, Murphy MS. Comparison of incidence of postoperative seroma between flapless and conventional techniques for thyroidectomy: a case-control study. *Clinical otolaryngology.* 2012;37:130-135. <https://doi.org/10.1111/j.1749-4486.2012.02454.x>.
555. Sanabria A, Carvalho AL, Silver CE, Rinaldo A, Shaha AR, Kowalski LP, et al. Routine drainage after thyroid surgery--a meta-analysis. *Journal of surgical oncology.* 2007;96:273-280. <https://doi.org/10.1002/jso.20821>.
556. Loyo M, Tufano RP, Gourin CG. National trends in thyroid surgery and the effect of volume on short-term outcomes. *The Laryngoscope.* 2013;123:2056-2063. <https://doi.org/10.1002/lary.23923>.
557. Lee YS, Nam KH, Chung WY, Chang HS, Park CS. Postoperative complications of thyroid cancer in a single center experience. *Journal of Korean medical science.* 2010;25:541-545. <https://doi.org/10.3346/jkms.2010.25.4.541>.
558. Zanolco KA, Wang MM, Yeh MW, Livhits MJ. Selective use of Molecular Testing Based on Sonographic Features of Cytologically Indeterminate Thyroid Nodules: A Decision Analysis. *World journal of surgery.* 2019;393-401. <https://doi.org/10.1007/s00268-019-05177-7>.
559. Verloop H, Louwerens M, Schoones JW, Kievit J, Smit JW, Dekkers OM. Risk of hypothyroidism following hemithyroidectomy: systematic review and meta-analysis of prognostic studies. *The Journal of clinical endocrinology and metabolism.* 2012;97:2243-2255. <https://doi.org/10.1210/jc.2012-1063>.
560. D'Orazi V, Sacconi A, Trombetta S, Karpathiotakis M, Pichelli D, Di Lorenzo E, et al. May predictors of difficulty in thyroid surgery increase the incidence of complications? Prospective study with the proposal of a preoperative score. *BMC surgery.* 2019;18:116. <https://doi.org/10.1186/s12893-018-0447-7>.
561. Ramouz A, Rashiashemi SZ, Daghigh F, Faraji E, Rouhani S. Predisposing factors for seroma formation in patients undergoing thyroidectomy: Cross-sectional study. *Ann Med Surg.* 2017;23:8-12. <https://doi.org/10.1016/j.amsu.2017.09.001>.
562. Zanolco K, Heller M, Elaraj D, Surgeon C. Is subtotal thyroidectomy a cost-effective treatment for Graves disease? A cost-effectiveness analysis of the medical and surgical treatment options. *Surgery.* 2012;152:164-172. <https://doi.org/10.1016/j.surg.2012.02.020>.

563. Shrimel MG, Goldstein DP, Seaberg RM, Sawka AM, Rotstein L, Freeman JL, et al. Cost-effective management of low-risk papillary thyroid carcinoma. *Archives of otolaryngology - head & neck surgery*. 2007;133:1245-1253. <https://doi.org/10.1001/archotol.133.12.1245>.
564. Esnaola NF, Cantor SB, Sherman SI, Lee JE, Evans DB. Optimal treatment strategy in patients with papillary thyroid cancer: a decision analysis. *Surgery*. 2001;130:921-930. <https://doi.org/10.1067/msy.2001.118370>.
565. Neudeck MR, Steinert H, Moergeli H, Weidt S, Seiler A, Strobel K, et al. Work ability and return to work in thyroid cancer patients and their partners: a pilot study. *Psychooncology*. 2017;26:556-559. <https://doi.org/10.1002/pon.4154>.
566. Ketterl TG, Syrjala KL, Casillas J, Jacobs LA, Palmer SC, McCabe MS, et al. Lasting effects of cancer and its treatment on employment and finances in adolescent and young adult cancer survivors. *Cancer*. 2019;125:1908-1917. <https://doi.org/10.1002/cncr.31985>.
567. Leso V, Vetrani I, De Cicco L, Cardelia A, Fontana L, Buonocore G, et al. The Impact of Thyroid Diseases on the Working Life of Patients: A Systematic Review. *Int J Environ Res Public Health*. 2020;17. <https://doi.org/10.3390/ijerph17124295>.
568. Waissi F, Kist JW, Lodewijk L, de Wit AG, van der Hage JA, van Dalen T, et al. Fast-track Radioiodine Ablation Therapy After Thyroidectomy Reduces Sick Leave in Patients With Differentiated Thyroid Cancer (FASTHYNA Trial). *Clinical nuclear medicine*. 2019;44:272-275. <https://doi.org/10.1097/RLU.0000000000002420>.
569. Borget I, Corone C, Nocaudie M, Allyn M, Iacobelli S, Schlumberger M, et al. Sick leave for follow-up control in thyroid cancer patients: comparison between stimulation with Thyrogen and thyroid hormone withdrawal. *European journal of endocrinology*. 2007;156:531-538. <https://doi.org/10.1530/EJE-06-0724>.
570. Emmanouilidis N, Schrem H, Winkler M, Klemphauer J, Scheumann GF. Long-term results after treatment of very low-, low-, and high-risk thyroid cancers in a combined setting of thyroidectomy and radio ablation therapy in euthyroidism. *Int J Endocrinol*. 2013;2013:769473. <https://doi.org/10.1155/2013/769473>.
571. 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;15:1147-1155. <https://doi.org/10.1089/thy.2005.15.1147>.
572. Nijhuis TF, van Weperen W, de Klerk JMH. Kosten samenhangend met de onttrekking van schildklierhormoontherapie bij de follow-up van het gedifferentieerde schildklier carcinoom. *Tijdschr Nucl Geneesk*. 1999;21:98-100.
573. Dow KH, Ferrell BR, Anello C. Quality-of-life changes in patients with thyroid cancer after withdrawal of thyroid hormone therapy. *Thyroid*. 1997;7:613-619. <https://doi.org/10.1089/thy.1997.7.613>.
574. Park JH, Park EC, Park JH, Kim SG, Lee SY. Job loss and re-employment of cancer patients in Korean employees: a nationwide retrospective cohort study. *Journal of clinical oncology*. 2008;26:1302-1309. <https://doi.org/10.1200/JCO.2007.14.2984>.
575. Tamminga SJ, Bultmann U, Husson O, Kuijpers JL, Frings-Dresen MH, de Boer AG. Employment and insurance outcomes and factors associated with employment among long-term thyroid cancer survivors: a population-based study from the PROFILES registry. *Quality of life research*. 2016;25:997-1005. <https://doi.org/10.1007/s11136-015-1135-z>.
576. van Buuren S. *Flexible Imputation of Missing Data*. Second Edition. Boca Raton, FL, USA: CRC Press; 2018.
577. Olvera Astivia OL, Zumbo BD. Heteroskedasticity in Multiple Regression Analysis: What it is, How to Detect it and How to Solve it with Applications in R and SPSS. *Practical Assessment, Research, and Evaluation*. 2019;24. <https://doi.org/10.7275/q5xr-fr95>.
578. Pomp M, Brouwer W, Rutten F. QALY-time: New medical Technology. cost-effectiveness and guidelines ["QALY-tijd: Nieuwe medische technologie, kosteneffectiviteit en richtlijnen"] (CPB Document 152). 2007.
579. Hu QL, Schumm MA, Zanocco KA, Yeh MW, Livhits MJ, Wu JX. Cost analysis of reflexive versus selective molecular testing for indeterminate thyroid nodules. *Surgery*. 2022;171:147-154. <https://doi.org/10.1016/j.surg.2021.04.050>.
580. Schumm MA, Nguyen DT, Kim J, Tseng CH, Chow AY, Shen N, et al. Longitudinal Assessment of Quality of Life Following Molecular Testing for Indeterminate Thyroid Nodules. *Annals of surgical oncology*. 2021;28:8872-8881. <https://doi.org/10.1245/s10434-021-10375-6>.
581. Bernet VJ, Chindris AM. Update on the Evaluation of Thyroid Nodules. *Journal of nuclear medicine*. 2021;62:13S-19S. <https://doi.org/10.2967/jnumed.120.246025>.
582. Applewhite MK, James BC, Kaplan SP, Angelos P, Kaplan EL, Grogan RH, et al. Quality of Life in Thyroid Cancer is Similar to That of Other Cancers with Worse Survival. *World journal of surgery*. 2016;40:551-561. <https://doi.org/10.1007/s00268-015-3300-5>.
583. Bianchi GP, Zaccheroni V, Solaroli E, Vescini F, Cerutti R, Zoli M, et al. Health-related quality of life in patients with thyroid disorders. *Quality of life research*. 2004;13:45-54. <https://doi.org/10.1023/B:QURE.0000015315.35184.66>.

584. Mirallie E, Borel F, Tresallet C, Hamy A, Mathonnet M, Lifante JC, et al. Impact of total thyroidectomy on quality of life at 6 months: the prospective ThyQoL multicentre trial. *European journal of endocrinology*. 2020;182:195-205. <https://doi.org/10.1530/eje-19-0587>.
585. Shah MD, Witterick IJ, Eski SJ, Pinto R, Freeman JL. Quality of life in patients undergoing thyroid surgery. *The Journal of otolaryngology*. 2006;35:209-215. <https://doi.org/10.2310/7070.2006.0011>.
586. Dogan S, Sahbaz NA, Aksal N, Tatal F, Torun BC, Yildirim NK, et al. Quality of life after thyroid surgery. *Journal of endocrinological investigation*. 2017;40:1085-1090. <https://doi.org/10.1007/s40618-017-0635-9>.
587. Nickel B, Tan T, Cvejic E, Baade P, McLeod DSA, Pandeya N, et al. Health-Related Quality of Life After Diagnosis and Treatment of Differentiated Thyroid Cancer and Association With Type of Surgical Treatment. *JAMA otolaryngology - head & neck surgery*. 2019;145:231-238. <https://doi.org/10.1001/jamaoto.2018.3870>.
588. Sorensen JR, Watt T, Cramon P, Dossing H, Hegedus L, Bonnema SJ, et al. Quality of life after thyroidectomy in patients with nontoxic nodular goiter: A prospective cohort study. *Head & neck*. 2017;39:2232-2240. <https://doi.org/10.1002/hed.24886>.
589. Buttner M, Locati LD, Pinto M, Araujo C, Tomaszewska IM, Kiyota N, et al. Quality of Life in Patients With Hypoparathyroidism After Treatment for Thyroid Cancer. *The Journal of clinical endocrinology and metabolism*. 2020;105:e4652-e4660. <https://doi.org/10.1210/clinem/dgaa597>.
590. Kurumety SK, Helenowski IB, Goswami S, Peipert BJ, Yount SE, Sturgeon C. Post-thyroidectomy neck appearance and impact on quality of life in thyroid cancer survivors. *Surgery*. 2019;165:1217-1221. <https://doi.org/10.1016/j.surg.2019.03.006>.
591. Kletzien H, Macdonald CL, Orne J, Francis DO, Levenson G, Wendt E, et al. Comparison Between Patient-Perceived Voice Changes and Quantitative Voice Measures in the First Postoperative Year After Thyroidectomy: A Secondary Analysis of a Randomized Clinical Trial. *JAMA otolaryngology - head & neck surgery*. 2018;144:995-1003. <https://doi.org/10.1001/jamaoto.2018.0309>.
592. Goswami S, Peipert BJ, Mongelli MN, Kurumety SK, Helenowski IB, Yount SE, et al. Clinical factors associated with worse quality-of-life scores in United States thyroid cancer survivors. *Surgery*. 2019;166:69-74. <https://doi.org/10.1016/j.surg.2019.01.034>.
593. Jeon MJ, Lee YM, Sung TY, Han M, Shin YW, Kim WG, et al. Quality of Life in Patients with Papillary Thyroid Microcarcinoma Managed by Active Surveillance or Lobectomy: A Cross-Sectional Study. *Thyroid*. 2019;29:956-962. <https://doi.org/10.1089/thy.2018.0711>.
594. Wong CW, Schumm MA, Zhu CY, Tseng CH, Arasu A, Han J, et al. Quality of Life Following Molecular Marker Testing for Indeterminate Thyroid Nodules. *Endocrine practice*. 2020;26:960-966. <https://doi.org/10.4158/EP-2020-0101>.
595. Ware JE, Jr. SF-36 health survey update. *Spine*. 2000;25:3130-3139. <https://doi.org/10.1097/00007632-200012150-00008>.
596. Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. *Journal of health economics*. 2002;21:271-292. [https://doi.org/10.1016/S0167-6296\(01\)00130-8](https://doi.org/10.1016/S0167-6296(01)00130-8).
597. Watt T, Bjorner JB, Groenvold M, Rasmussen AK, Bonnema SJ, Hegedus L, et al. Establishing construct validity for the thyroid-specific patient reported outcome measure (ThyPRO): an initial examination. *Quality of life research*. 2009;18:483-496. <https://doi.org/10.1007/s11136-009-9460-8>.
598. Watt T, Bjorner JB, Groenvold M, Cramon P, Winther KH, Hegedus L, et al. Development of a Short Version of the Thyroid-Related Patient-Reported Outcome ThyPRO. *Thyroid*. 2015;25:1069-1079. <https://doi.org/10.1089/thy.2015.0209>.
599. Nordqvist SF, Boesen VB, Rasmussen AK, Feldt-Rasmussen U, Hegedus L, Bonnema SJ, et al. Determining minimal important change for the thyroid-related quality of life questionnaire ThyPRO. *Endocr Connect*. 2021;10:316-324. <https://doi.org/10.1530/EC-21-0026>.
600. Guyatt GH, Osoba D, Wu AW, Wyrwich KW, Norman GR, Clinical Significance Consensus Meeting G. Methods to explain the clinical significance of health status measures. *Mayo Clin Proc*. 2002;77:371-383. <https://doi.org/10.4065/77.4.371>.
601. Ahn J, Jeon MJ, Song E, Kim TY, Kim WB, Shong YK, et al. Quality of Life in Patients with Papillary Thyroid Microcarcinoma According to Treatment: Total Thyroidectomy with or without Radioactive Iodine Ablation. *Endocrinology and metabolism*. 2020;35:115-121. <https://doi.org/10.3803/EnM.2020.35.115>.
602. Dingle IF, Mishoe AE, Nguyen SA, Overton LJ, Gillespie MB. Salivary morbidity and quality of life following radioactive iodine for well-differentiated thyroid cancer. *Otolaryngology - head and neck surgery*. 2013;148:746-752. <https://doi.org/10.1177/0194599813479777>.
603. McClure NS, Sayah FA, Xie F, Luo N, Johnson JA. Instrument-Defined Estimates of the Minimally Important Difference for EQ-5D-5L Index Scores. *Value in health*. 2017;20:644-650. <https://doi.org/10.1016/j.jval.2016.11.015>.
604. Henry EB, Barry LE, Hobbins AP, McClure NS, O'Neill C. Estimation of an Instrument-Defined Minimally Important Difference in EQ-5D-5L Index Scores Based on Scoring Algorithms Derived Using the EQ-VT Version 2 Valuation Protocols. *Value in health*. 2020;23:936-944. <https://doi.org/10.1016/j.jval.2020.03.003>.

605. Nolte S, Liegl G, Petersen MA, Aaronson NK, Costantini A, Fayers PM, et al. General population normative data for the EORTC QLQ-C30 health-related quality of life questionnaire based on 15,386 persons across 13 European countries, Canada and the United States. *Eur J Cancer*. 2019;107:153-163. <https://doi.org/10.1016/j.ejca.2018.11.024>.
606. Norman GR, Sloan JA, Wywich KW. Interpretation of changes in health-related quality of life: the remarkable universality of half a standard deviation. *Med Care*. 2003;41:582-592. <https://doi.org/10.1097/01.MLR.0000062554.74615.4C>.
607. Smith VA, Coffman CJ, Hudgens MG. Interpreting the Results of Intention-to-Treat, Per-Protocol, and As-Treated Analyses of Clinical Trials. *JAMA*. 2021;326:433-434. <https://doi.org/10.1001/jama.2021.2825>.
608. Bell BA, Morgan GB, Schoeneberger JA, Kromrey JD, Ferron JM. How Low Can You Go?: An Investigation of the Influence of Sample Size and Model Complexity on Point and Interval Estimates in Two-Level Linear Models. *Methodology*. 2014;10:1-11. <https://doi.org/10.1027/1614-2241/a000062>.
609. Liberti MV, Locasale JW. The Warburg effect: how does it benefit cancer cells? *Trends Biochem Sci*. 2016;41:211-218. <https://doi.org/10.1016/j.tibs.2015.12.001>.
610. Piccardo A, Puntoni M, Bertagna F, Treglia G, Foppiani L, Arecco F, et al. 18F-FDG uptake as a prognostic variable in primary differentiated thyroid cancer incidentally detected by PET/CT: a multicentre study. *Eur J Nucl Med Mol Imaging*. 2014;41:1482-1491. <https://doi.org/10.1007/s00259-014-2774-y>.
611. Santhanam P, Khthir R, Solnes LB, Ladenson PW. The relationship of BRAF(V600e) mutation status to FDG PET/CT avidity in thyroid cancer: a review and meta-analysis. *Endocrine practice*. 2018;24:21-26. <https://doi.org/10.4158/EP-2017-0080>.
612. van Berkel A, Rao JU, Kusters B, Demir T, Visser E, Mensenkamp AR, et al. Correlation between in vivo 18F-FDG PET and immunohistochemical markers of glucose uptake and metabolism in pheochromocytoma and paraganglioma. *Journal of nuclear medicine*. 2014;55:1253-1259. <https://doi.org/10.2967/jnumed.114.137034>.
613. Meyer HJ, Wienke A, Surov A. Associations between GLUT expression and SUV values derived from FDG-PET in different tumors-A systematic review and meta analysis. *PLoS one*. 2019;14:e0217781. <https://doi.org/10.1371/journal.pone.0217781>.
614. de Geus-Oei LF, van Krieken JH, Aliredjo RP, Krabbe PF, Frielink C, Verhagen AF, et al. Biological correlates of FDG uptake in non-small cell lung cancer. *Lung Cancer*. 2007;55:79-87. <https://doi.org/10.1016/j.lungcan.2006.08.018>.
615. Kim MH, Ko SH, Bae JS, Lee SH, Jung CK, Lim DJ, et al. Non-FDG-avid primary papillary thyroid carcinoma may not differ from FDG-avid papillary thyroid carcinoma. *Thyroid*. 2013;23:1452-1460. <https://doi.org/10.1089/thy.2013.0051>.
616. Dierckx RA, Van de Wiele C. FDG uptake, a surrogate of tumour hypoxia? *Eur J Nucl Med Mol Imaging*. 2008;35:1544-1549. <https://doi.org/10.1007/s00259-008-0758-5>.
617. Busk M, Horsman MR, Jakobsen S, Bussink J, van der Kogel A, Overgaard J. Cellular uptake of PET tracers of glucose metabolism and hypoxia and their linkage. *Eur J Nucl Med Mol Imaging*. 2008;35:2294-2303. <https://doi.org/10.1007/s00259-008-0888-9>.
618. Schuurbijs OC, Meijer TW, Kaanders JH, Looijen-Salamon MG, de Geus-Oei LF, van der Drift MA, et al. Glucose metabolism in NSCLC is histology-specific and diverges the prognostic potential of 18FDG-PET for adenocarcinoma and squamous cell carcinoma. *J Thorac Oncol*. 2014;9:1485-1493. <https://doi.org/10.1097/JTO.0000000000000286>.
619. Klaus A, Fathi O, Tatjana TW, Bruno N, Oskar K. Expression of hypoxia-associated protein HIF-1alpha in follicular thyroid cancer is associated with distant metastasis. *Pathol Oncol Res*. 2018;24:289-296. <https://doi.org/10.1007/s12253-017-0232-4>.
620. Nahm JH, Kim HM, Koo JS. Glycolysis-related protein expression in thyroid cancer. *Tumour biology : the journal of the International Society for Oncodevelopmental Biology and Medicine*. 2017;39:1-10. <https://doi.org/10.1177/1010428317695922>.
621. Kim HM, Koo JS. Differential expression of glycolysis-related proteins in follicular neoplasms versus hurthle cell neoplasms: a retrospective analysis. *Dis Markers*. 2017;2017:6230294. <https://doi.org/10.1155/2017/6230294>.
622. Meijer TW, Schuurbijs OC, Kaanders JH, Looijen-Salamon MG, de Geus-Oei LF, Verhagen AF, et al. Differences in metabolism between adeno- and squamous cell non-small cell lung carcinomas: spatial distribution and prognostic value of GLUT1 and MCT4. *Lung Cancer*. 2012;76:316-323. <https://doi.org/10.1016/j.lungcan.2011.11.006>.
623. Kaida H, Kawahara A, Hayakawa M, Hattori S, Kurata S, Fujimoto K, et al. The difference in relationship between 18F-FDG uptake and clinicopathological factors on thyroid, esophageal, and lung cancers. *Nuclear medicine communications*. 2014;35:36-43. <https://doi.org/10.1097/MNM.000000000000019>.
624. Grabellus F, Nagarajah J, Bockisch A, Schmid KW, Sheu SY. Glucose transporter 1 expression, tumor proliferation, and iodine/glucose uptake in thyroid cancer with emphasis on poorly differentiated thyroid carcinoma. *Clinical nuclear medicine*. 2012;37:121-127. <https://doi.org/10.1097/RLU.0b013e3182393599>.
625. Kjellman P, Wallin G, Hoog A, Auer G, Larsson C, Zedenius J. MIB-1 index in thyroid tumors: a predictor of the clinical course in papillary thyroid carcinoma. *Thyroid*. 2003;13:371-380. <https://doi.org/10.1089/105072503321669866>.

626. Itoh A, Iwase K, Jimbo S, Yamamoto H, Yamamoto N, Kokubo M, et al. Expression of vascular endothelial growth factor and presence of angiovascular cells in tissues from different thyroid disorders. *World journal of surgery*. 2010;34:242-248. <https://doi.org/10.1007/s00268-009-0344-4>.
627. Ryan HE, Poloni M, McNulty W, Elson D, Gassmann M, Arbeit JM, et al. Hypoxia-inducible factor-1alpha is a positive factor in solid tumor growth. *Cancer Res*. 2000;60:4010-4015.
628. Hooft L, van der Veldt AA, van Diest PJ, Hoekstra OS, Berkhof J, Teule GJ, et al. [18F]fluorodeoxyglucose uptake in recurrent thyroid cancer is related to hexokinase i expression in the primary tumor. *The Journal of clinical endocrinology and metabolism*. 2005;90:328-334. <https://doi.org/10.1210/jc.2004-0779>.
629. Kaira K, Serizawa M, Koh Y, Takahashi T, Yamaguchi A, Hanaoka H, et al. Biological significance of 18F-FDG uptake on PET in patients with non-small-cell lung cancer. *Lung Cancer*. 2014;83:197-204. <https://doi.org/10.1016/j.lungcan.2013.11.025>.
630. Qichang W, Lin B, Gege Z, Youjia Z, Qingjie M, Renjie W, et al. Diagnostic performance of 18F-FDG-PET/CT in DTC patients with thyroglobulin elevation and negative iodine scintigraphy: a meta-analysis. *European journal of endocrinology*. 2019;181:93-102. <https://doi.org/10.1530/EJE-19-0261>.
631. Kollecker I, von Wasielewski R, Langner C, Muller JA, Spitzweg C, Kreipe H, et al. Subcellular distribution of the sodium iodide symporter in benign and malignant thyroid tissues. *Thyroid*. 2012;22:529-535. <https://doi.org/10.1089/thy.2011.0311>.
632. Kim S, Chung JK, Min HS, Kang JH, Park DJ, Jeong JM, et al. Expression patterns of glucose transporter-1 gene and thyroid specific genes in human papillary thyroid carcinoma. *Nuclear medicine and molecular imaging*. 2014;48:91-97. <https://doi.org/10.1007/s13139-013-0249-x>.
633. Yoon M, Jung SJ, Kim TH, Ha TK, Urm SH, Park JS, et al. Relationships between transporter expression and the status of BRAF V600E mutation and F-18 FDG uptake in papillary thyroid carcinomas. *Endocrine research*. 2016;41:64-69. <https://doi.org/10.3109/07435800.2015.1066803>.
634. Kim BH, Kim IJ, Kim SS, Kim SJ, Lee CH, Kim YK. Relationship between biological marker expression and fluorine-18 fluorodeoxyglucose uptake in incidentally detected thyroid cancer. *Cancer biotherapy & radiopharmaceuticals*. 2010;25:309-315. <https://doi.org/10.1089/cbr.2009.0636>.
635. Lansoy-Kuhn C, Picquet JM, Edet-Sanson A, Mechken F, Laberge-Le Couteulx S, Cornic M, et al. Relationship between the immunohistochemistry of the primary tumour and 18F-FDG-PET/CT at recurrence in patients with well-differentiated thyroid carcinoma. *Nuclear medicine communications*. 2013;34:340-346. <https://doi.org/10.1097/MNM.0b013e32835e59ee>.
636. Ciampi R, Vivaldi A, Romei C, Del Guerra A, Salvadori P, Cosci B, et al. Expression analysis of facilitative glucose transporters (GLUTs) in human thyroid carcinoma cell lines and primary tumors. *Mol Cell Endocrinol*. 2008;291:57-62. <https://doi.org/10.1016/j.mce.2008.05.003>.
637. Yasuda M, Ogane N, Hayashi H, Kameda Y, Miyagi Y, Iida T, et al. Glucose transporter-1 expression in the thyroid gland: clinicopathological significance for papillary carcinoma. *Oncol Rep*. 2005;14:1499-1504. <https://doi.org/10.3892/or.14.6.1499>.
638. Mu N, Juhlin CC, Tani E, Sofiadis A, Reihner E, Zedenius J, et al. High Ki-67 index in fine needle aspiration cytology of follicular thyroid tumors is associated with increased risk of carcinoma. *Endocrine*. 2018;61:293-302. <https://doi.org/10.1007/s12020-018-1627-z>.
639. Remmele W, Stegner HE. [Recommendation for uniform definition of an immunoreactive score (IRS) for immunohistochemical estrogen receptor detection (ER-ICA) in breast cancer tissue]. *Pathologe*. 1987;8:138-140.
640. Demsar J, Curk T, Erjavec A, Gorup C, Hocevar T, Milutinovic M, et al. Orange: data mining toolbox in Python. *Journal of Machine Learning Research*. 2013;14:2349-2353.
641. Matsuzu K, Segade F, Matsuzu U, Carter A, Bowden DW, Perrier ND. Differential expression of glucose transporters in normal and pathologic thyroid tissue. *Thyroid*. 2004;14:806-812. <https://doi.org/10.1089/thy.2004.14.806>.
642. Lewy-Trenda I, Wierchniewska-Lawska A. Expression of vascular endothelial growth factor (VEGF) in human thyroid tumors. *Pol J Pathol*. 2002;53:129-132.
643. Morari EC, Marcello MA, Guilhen AC, Cunha LL, Latuff P, Soares FA, et al. Use of sodium iodide symporter expression in differentiated thyroid carcinomas. *Clinical endocrinology*. 2011;75:247-254. <https://doi.org/10.1111/j.1365-2265.2011.04032.x>.
644. Zerilli M, Zito G, Martorana A, Pitrone M, Cabibi D, Cappello F, et al. BRAF(V600E) mutation influences hypoxia-inducible factor-1alpha expression levels in papillary thyroid cancer. *Mod Pathol*. 2010;23:1052-1060. <https://doi.org/10.1038/modpathol.2010.86>.
645. Prante O, Maschauer S, Fremont V, Reinfelder J, Stoehr R, Szkudlinski M, et al. Regulation of uptake of 18F-FDG by a follicular human thyroid cancer cell line with mutation-activated K-ras. *Journal of nuclear medicine*. 2009;50:1364-1370. <https://doi.org/10.2967/jnumed.109.062331>.
646. Morani F, Pagano L, Prodam F, Aimaretti G, Isidoro C. Loss of expression of the oncosuppressor PTEN in thyroid incidentalomas associates with GLUT1 plasmamembrane expression. *Panminerva Med*. 2012;54:59-63.

647. Heydarzadeh S, Moshtaghi AA, Daneshpoor M, Hedayati M. Regulators of glucose uptake in thyroid cancer cell lines. *Cell Commun Signal*. 2020;18:83. <https://doi.org/10.1186/s12964-020-00586-x>.
648. Matsuura D, Yuan A, Wang LY, Ranganath R, Adilbay D, Harries V, et al. Follicular and hurthle cell carcinoma: comparison of clinicopathological features and clinical outcomes. *Thyroid*. 2022;32:245-254. <https://doi.org/10.1089/thy.2021.0424>.
649. Corver WE, Demmers J, Oosting J, Sahraeian S, Boot A, Ruano D, et al. ROS-induced near-homozygous genomes in thyroid cancer. *Endocrine-related cancer*. 2018;25:83-97. <https://doi.org/10.1530/ERC-17-0288>.
650. Strieder DL, Cristo AP, Zanella AB, Faccin CS, Farenzena M, Graudenz MS, et al. Using an ultrasonography risk stratification system to enhance the thyroid fine needle aspiration performance. *Eur J Radiol*. 2022;150:110244. <https://doi.org/10.1016/j.ejrad.2022.110244>.
651. de Koster EJ, de Geus-Oei LF, Dekkers OM, van Engen-van Grunsven I, Hamming J, Corssmit EPM, et al. Diagnostic Utility of Molecular and Imaging Biomarkers in Cytological Indeterminate Thyroid Nodules. *Endocr Rev*. 2018;39:154-191. <https://doi.org/10.1210/er.2017-00133>.
652. Joensuu H, Ahonen A, Klemlj PJ. 18F-fluorodeoxyglucose imaging in preoperative diagnosis of thyroid malignancy. *Eur J Nucl Med*. 1988;13:502-506. <https://doi.org/10.1007/BF00256624>.
653. Adler LP, Bloom AD. Positron emission tomography of thyroid masses. *Thyroid*. 1993;3:195-200. <https://doi.org/10.1089/thy.1993.3.195>.
654. Bloom AD, Adler LP, Shuck JM. Determination of malignancy of thyroid nodules with positron emission tomography. *Surgery*. 1993;114:728-734; discussion 734-725.
655. Salvatori M, Biondi B, Rufini V. Imaging in endocrinology: 2-[18F]-fluoro-2-deoxy-D-glucose positron emission tomography/computed tomography in differentiated thyroid carcinoma: clinical indications and controversies in diagnosis and follow-up. *Eur J Endocrinol*. 2015;173:R115-130. <https://doi.org/10.1530/EJE-15-0066>.
656. Pak K, Kim SJ, Kim IJ, Kim BH, Kim SS, Jeon YK. The role of 18F-fluorodeoxyglucose positron emission tomography in differentiated thyroid cancer before surgery. *Endocr Relat Cancer*. 2013;20:R203-213. <https://doi.org/10.1530/ERC-13-0088>.
657. 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;42:38. <https://doi.org/10.1186/1916-0216-42-38>.
658. 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;8. <https://doi.org/10.3390/jcm8091333>.
659. Qichang W, Jinming S, Lu L, Bin J, Renjie W, Xiuying Z. Comparison of 18F-FDG-PET and 18F-FDG-PET/CT for the diagnostic performance in thyroid nodules with indeterminate cytology: A meta-analysis. *Medicine (Baltimore)*. 2020;99:e20446. <https://doi.org/10.1097/MD.000000000020446>.
660. Scappaticcio L, Piccardo A, Treglia G, Poller DN, Trimboli P. The dilemma of (18)F-FDG PET/CT thyroid incidentaloma: what we should expect from FNA. A systematic review and meta-analysis. *Endocrine*. 2021;73:540-549. <https://doi.org/10.1007/s12020-021-02683-4>.
661. de Koster EJ, de Geus-Oei LF, Brouwers AH, van Dam E, Dijkhorst-Oei LT, van Engen-van Grunsven ACH, et al. [(18)F]FDG-PET/CT to prevent futile surgery in indeterminate thyroid nodules: a blinded, randomised controlled multicentre trial. *Eur J Nucl Med Mol Imaging*. 2022;49:1970-1984. <https://doi.org/10.1007/s00259-021-05627-2>.
662. de Koster EJ, Noortman WA, Mostert JM, Booi J, Brouwer CB, de Keizer B, et al. Quantitative classification and radiomics of [(18)F]FDG-PET/CT in indeterminate thyroid nodules. *Eur J Nucl Med Mol Imaging*. 2022;49:2174-2188. <https://doi.org/10.1007/s00259-022-05712-0>.
663. de Koster EJ, Vriens D, van Aken MO, Dijkhorst-Oei LT, Oyen WJG, Peeters RP, et al. FDG-PET/CT in indeterminate thyroid nodules: cost-utility analysis alongside a randomised controlled trial. *Eur J Nucl Med Mol Imaging*. 2022;49:3452-3469. <https://doi.org/10.1007/s00259-022-05794-w>.
664. de Koster EJ, Husson O, van Dam E, Mijnhout GS, Netea-Maier RT, Oyen WJG, et al. Health-related quality of life following FDG-PET/CT for cytological indeterminate thyroid nodules. *Endocr Connect*. 2022;11. <https://doi.org/10.1530/EC-22-0014>.
665. de Koster EJ, van Engen-van Grunsven ACH, Bussink J, Frielink C, de Geus-Oei LF, Kusters B, et al. [(18)F]FDG Uptake and Expression of Immunohistochemical Markers Related to Glycolysis, Hypoxia, and Proliferation in Indeterminate Thyroid Nodules. *Mol Imaging Biol*. 2022. <https://doi.org/10.1007/s11307-022-01776-4>.
666. Thuillier P, Benisvy D, Ansquer C, Corvilain B, Mirallie E, Taieb D, et al. Section 5: What is the role of functional imaging and isotopic treatment? *Ann Endocrinol (Paris)*. 2022. <https://doi.org/10.1016/j.ando.2022.10.008>.
667. Durante C, Grani G, Lamartina L, Filetti S, Mandel SJ, Cooper DS. The Diagnosis and Management of Thyroid Nodules: A Review. *JAMA*. 2018;319:914-924. <https://doi.org/10.1001/jama.2018.0898>.

668. Goffredo P, Roman SA, Sosa JA. Hurthle cell carcinoma: a population-level analysis of 3311 patients. *Cancer*. 2013;119:504-511. <https://doi.org/10.1002/cncr.27770>.
669. Thodou E, Canberk S, Schmitt F. Challenges in Cytology Specimens With Hurthle Cells. *Frontiers in endocrinology*. 2021;12:701877. <https://doi.org/10.3389/fendo.2021.701877>.
670. Grant CS, Barr D, Goellner JR, Hay ID. Benign Hurthle cell tumors of the thyroid: a diagnosis to be trusted? *World journal of surgery*. 1988;12:488-495. <https://doi.org/10.1007/BF01655429>.
671. Boronat M, Cabrera JJ, Perera C, Isla C, Novoa FJ. Late bone metastasis from an apparently benign oncocytic follicular thyroid tumor. *Endocrinol Diabetes Metab Case Rep*. 2013;2013:130051. <https://doi.org/10.1530/EDM-13-0051>.
672. Asa SL, Mete O. Oncocytic Change in Thyroid Pathology. *Frontiers in endocrinology*. 2021;12:678119. <https://doi.org/10.3389/fendo.2021.678119>.
673. Wada N, Duh QY, Miura D, Brunaud L, Wong MG, Clark OH. Chromosomal aberrations by comparative genomic hybridization in hurthle cell thyroid carcinomas are associated with tumor recurrence. *The Journal of clinical endocrinology and metabolism*. 2002;87:4595-4601. <https://doi.org/10.1210/jc.2002-020339>.
674. Ganly I, Makarov V, Deraje S, Dong Y, Reznik E, Seshan V, et al. Integrated Genomic Analysis of Hurthle Cell Cancer Reveals Oncogenic Drivers, Recurrent Mitochondrial Mutations, and Unique Chromosomal Landscapes. *Cancer Cell*. 2018;34:256-270 e255. <https://doi.org/10.1016/j.ccell.2018.07.002>.
675. Corver WE, van Wezel T, Molenaar K, Schrupf M, van den Akker B, van Eijk R, et al. Near-haploidization significantly associates with oncocytic adrenocortical, thyroid, and parathyroid tumors but not with mitochondrial DNA mutations. *Genes Chromosomes Cancer*. 2014;53:833-844. <https://doi.org/10.1002/gcc.22194>.
676. Jalaly JB, Baloch ZW. Hurthle-cell neoplasms of the thyroid: An algorithmic approach to pathologic diagnosis in light of molecular advances. *Semin Diagn Pathol*. 2020;37:234-242. <https://doi.org/10.1053/j.semdp.2020.03.004>.
677. Boot A, Oosting J, de Miranda NF, Zhang Y, Corver WE, van de Water B, et al. Imprinted survival genes preclude loss of heterozygosity of chromosome 7 in cancer cells. *J Pathol*. 2016;240:72-83. <https://doi.org/10.1002/path.4756>.
678. Stankov K, Pastore A, Toschi L, McKay J, Lesueur F, Kraimps JL, et al. Allelic loss on chromosomes 2q21 and 19p 13.2 in oxyphilic thyroid tumors. *International journal of cancer*. 2004;111:463-467. <https://doi.org/10.1002/ijc.20259>.
679. Tallini G, Hsueh A, Liu S, Garcia-Rostan G, Speicher MR, Ward DC. Frequent chromosomal DNA unbalance in thyroid oncocytic (Hurthle cell) neoplasms detected by comparative genomic hybridization. *Lab Invest*. 1999;79:547-555.
680. Santana NO, Lerario AM, Schmerling CK, Marui S, Alves VAF, Hoff AO, et al. Molecular profile of Hurthle cell carcinomas: recurrent mutations in the Wnt/beta-catenin pathway. *European journal of endocrinology / European Federation of Endocrine Societies*. 2020;183:647-656. <https://doi.org/10.1530/EJE-20-0597>.
681. Kumari S, Adewale R, Klubo-Gwiedzinska J. The Molecular Landscape of Hurthle Cell Thyroid Cancer Is Associated with Altered Mitochondrial Function-A Comprehensive Review. *Cells*. 2020;9. <https://doi.org/10.3390/cells9071570>.
682. Corver WE, Middeldorp A, ter Haar NT, Jordanova ES, van Puijenbroek M, van Eijk R, et al. Genome-wide allelic state analysis on flow-sorted tumor fractions provides an accurate measure of chromosomal aberrations. *Cancer Res*. 2008;68:10333-10340. <https://doi.org/10.1158/0008-5472.CAN-08-2665>.
683. Nikiforova MN, Mercurio S, Wald AI, Barbi de Moura M, Callenberg K, Santana-Santos L, et al. Analytical performance of the ThyroSeq v3 genomic classifier for cancer diagnosis in thyroid nodules. *Cancer*. 2018;124:1682-1690. <https://doi.org/10.1002/cncr.31245>.
684. Cohen D, Hondelink LM, Solleveld-Westerink N, Uljee SM, Ruano D, Cleton-Jansen AM, et al. Optimizing Mutation and Fusion Detection in NSCLC by Sequential DNA and RNA Sequencing. *J Thorac Oncol*. 2020;15:1000-1014. <https://doi.org/10.1016/j.jtho.2020.01.019>.
685. van der Tuin K, de Kock L, Kamping EJ, Hannema SE, Pouwels MM, Niedziela M, et al. Clinical and Molecular Characteristics May Alter Treatment Strategies of Thyroid Malignancies in DICER1 Syndrome. *The Journal of clinical endocrinology and metabolism*. 2019;104:277-284. <https://doi.org/10.1210/jc.2018-00774>.
686. van der Tuin K, Ventayol Garcia M, Corver WE, Khalifa MN, Ruano Neto D, Corssmit EPM, et al. Targetable gene fusions identified in radioactive iodine refractory advanced thyroid carcinoma. *European journal of endocrinology*. 2019;180:235-241. <https://doi.org/10.1530/EJE-18-0653>.
687. Plon SE, Eccles DM, Easton D, Foulkes WD, Genuardi M, Greenblatt MS, et al. Sequence variant classification and reporting: recommendations for improving the interpretation of cancer susceptibility genetic test results. *Hum Mutat*. 2008;29:1282-1291. <https://doi.org/10.1002/humu.20880>.
688. Corver WE, Ter Haar NT, Dreef EJ, Miranda NF, Prins FA, Jordanova ES, et al. High-resolution multi-parameter DNA flow cytometry enables detection of tumour and stromal cell subpopulations in paraffin-embedded tissues. *J Pathol*. 2005;206:233-241. <https://doi.org/10.1002/path.1765>.
689. Corver WE, Ter Haar NT, Fleuren GJ, Oosting J. Cervical carcinoma-associated fibroblasts are DNA diploid and do not show evidence for somatic genetic alterations. *Cell Oncol (Dordr)*. 2011;34:553-563. <https://doi.org/10.1007/s13402-011-0061-5>.

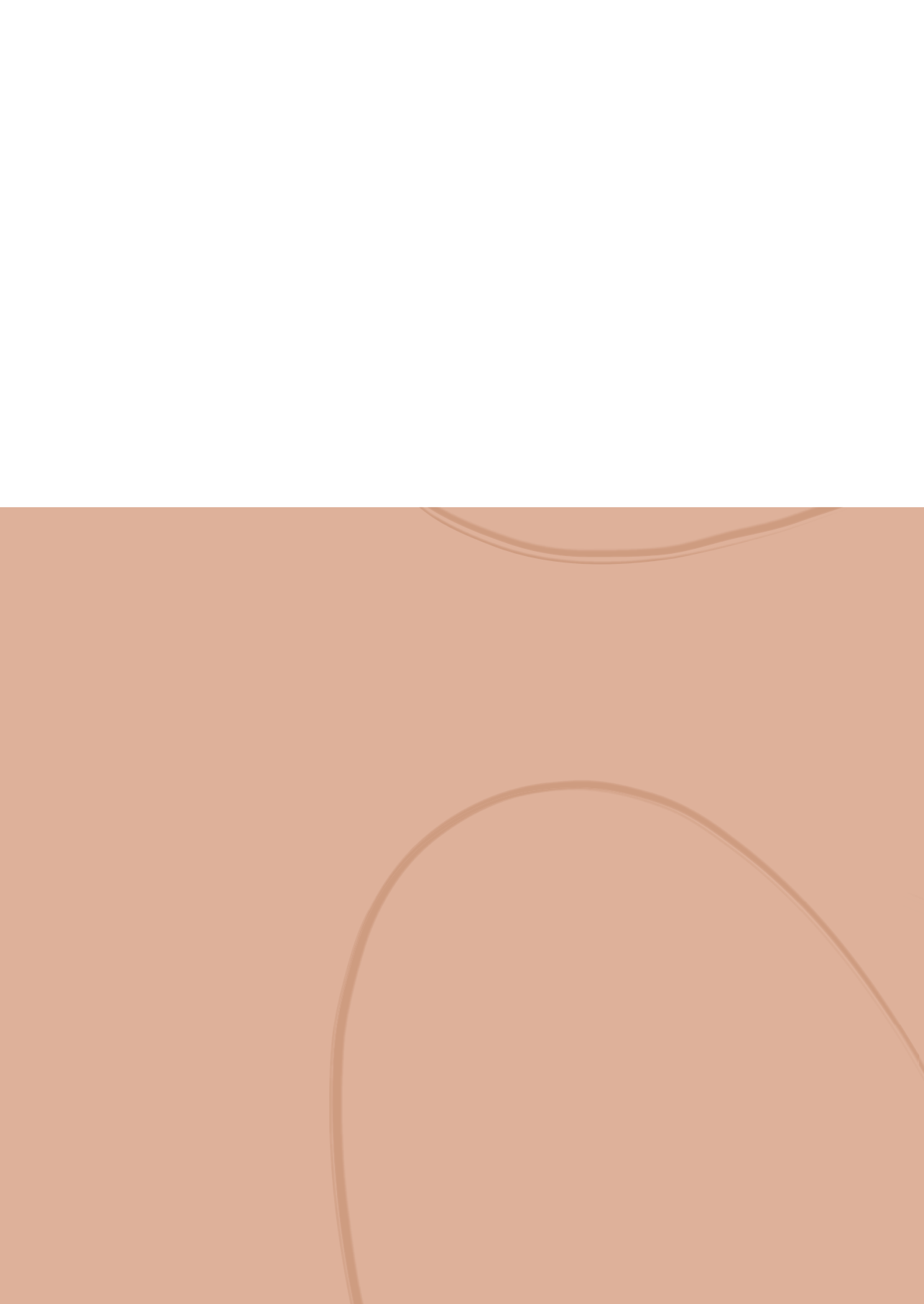
690. Santana NO, Freitas RMC, Marcos VN, Chammas MC, Camargo RYA, Schmerling CK, et al. Diagnostic performance of thyroid ultrasound in Hurthle cell carcinomas. *Arch Endocrinol Metab.* 2019;63:300-305. <https://doi.org/10.20945/2359-3997000000131>.
691. Yip L, Sosa JA. Molecular-Directed Treatment of Differentiated Thyroid Cancer: Advances in Diagnosis and Treatment. *JAMA Surg.* 2016;151:663-670. <https://doi.org/10.1001/jamasurg.2016.0825>.
692. Valderrabano P, Eszlinger M, Stewardson P, Paschke R. Clinical value of molecular markers as diagnostic and prognostic tools to guide treatment of thyroid cancer. *Clinical endocrinology.* 2023. <https://doi.org/10.1111/cen.14882>.
693. Silaghi CA, Lozovanu V, Georgescu CE, Georgescu RD, Susman S, Nasui BA, et al. Thyroseq v3, Afirma GSC, and microRNA Panels Versus Previous Molecular Tests in the Preoperative Diagnosis of Indeterminate Thyroid Nodules: A Systematic Review and Meta-Analysis. *Frontiers in endocrinology.* 2021;12:649522. <https://doi.org/10.3389/fendo.2021.649522>.
694. Patel SG, Carty SE, Lee AJ. Molecular Testing for Thyroid Nodules Including Its Interpretation and Use in Clinical Practice. *Annals of surgical oncology.* 2021. <https://doi.org/10.1245/s10434-021-10307-4>.
695. de Koster EJ, Corver WE, de Geus-Oei LF, Oyen WJG, Ruano D, Schepers A, et al. A clinically applicable molecular classification of oncocytic cell thyroid nodules. *Endocrine-related cancer.* 2023;30. <https://doi.org/10.1530/ERC-23-0047>.
696. Nasr CE, Andrioli M, Endo M, Harrell RM, Livhits MJ, Osakwe I, et al. Real-World Performance of the Afirma Genomic Sequencing Classifier (GSC)-A Meta-analysis. *The Journal of clinical endocrinology and metabolism.* 2023;108:1526-1532. <https://doi.org/10.1210/clinem/dgac688>.
697. DiGennaro C, Vahdatzad V, Jalali MS, Toumi A, Watson T, Gazelle GS, et al. Assessing Bias and Limitations of Clinical Validation Studies of Molecular Diagnostic Tests for Indeterminate Thyroid Nodules: Systematic Review and Meta-Analysis. *Thyroid.* 2022;32:1144-1157. <https://doi.org/10.1089/thy.2022.0269>.
698. Dublin JC, Papazian M, Zan E, Oweity T, Sun W, Jacobson A, et al. Predictive Value of a Genomic Classifier in Indeterminate Thyroid Nodules Based on Nodule Size. *JAMA otolaryngology - head & neck surgery.* 2022;148:53-60. <https://doi.org/10.1001/jamaoto.2021.3080>.
699. Yip L, Gooding WE, Nikitski A, Wald AI, Carty SE, Karslioglu-French E, et al. Risk assessment for distant metastasis in differentiated thyroid cancer using molecular profiling: A matched case-control study. *Cancer.* 2021;127:1779-1787. <https://doi.org/10.1002/cncr.33421>.
700. Schumm MA, Shu ML, Hughes EG, Nikiforov YE, Nikiforova MN, Wald AI, et al. Prognostic Value of Preoperative Molecular Testing and Implications for Initial Surgical Management in Thyroid Nodules Harboring Suspected (Bethesda V) or Known (Bethesda VI) Papillary Thyroid Cancer. *JAMA otolaryngology - head & neck surgery.* 2023;149:735-742. <https://doi.org/10.1001/jamaoto.2023.1494>.
701. Filetti S, Durante C, Hartl DM, Leboulleux S, Locati LD, Newbold K, et al. ESMO Clinical Practice Guideline update on the use of systemic therapy in advanced thyroid cancer. *Ann Oncol.* 2022;33:674-684. <https://doi.org/10.1016/j.annonc.2022.04.009>.
702. Greaves M, Maley CC. Clonal evolution in cancer. *Nature.* 2012;481:306-313. <https://doi.org/10.1038/nature10762>.
703. Yates LR, Campbell PJ. Evolution of the cancer genome. *Nat Rev Genet.* 2012;13:795-806. <https://doi.org/10.1038/nrg3317>.
704. Livhits MJ, Zhu CY, Kuo EJ, Nguyen DT, Kim J, Tseng CH, et al. Effectiveness of Molecular Testing Techniques for Diagnosis of Indeterminate Thyroid Nodules: A Randomized Clinical Trial. *JAMA Oncol.* 2021;7:70-77. <https://doi.org/10.1001/jamaoncol.2020.5935>.
705. Nikiforova MN, Lepe M, Tolino LA, Miller ME, Ohori NP, Wald AI, et al. Thyroid cytology smear slides: An untapped resource for ThyroSeq testing. *Cancer cytopathology.* 2021;129:33-42. <https://doi.org/10.1002/cncy.22331>.
706. Chen T, Gilfix BM, Rivera J, Sadeghi N, Richardson K, Hier MP, et al. The Role of the ThyroSeq v3 Molecular Test in the Surgical Management of Thyroid Nodules in the Canadian Public Health Care Setting. *Thyroid.* 2020;30:1280-1287. <https://doi.org/10.1089/thy.2019.0539>.
707. Suh HY, Choi H, Paeng JC, Cheon GJ, Chung JK, Kang KW. Comprehensive gene expression analysis for exploring the association between glucose metabolism and differentiation of thyroid cancer. *BMC cancer.* 2019;19:1260. <https://doi.org/10.1186/s12885-019-6482-7>.
708. de Koster EJ, van Engen-van Grunsven ACH, Bussink J, Frielink C, de Geus-Oei LF, Kusters B, et al. [(18)F]FDG Uptake and Expression of Immunohistochemical Markers Related to Glycolysis, Hypoxia, and Proliferation in Indeterminate Thyroid Nodules. *Mol Imaging Biol.* 2023;25:483-494. <https://doi.org/10.1007/s11307-022-01776-4>.
709. Quaytman JA, Nikiforov YE, Nikiforova MN, Morariu E. Clinicopathologic features of thyroid nodules with PTEN mutations on preoperative testing. *Endocrine-related cancer.* 2022;29:513-520. <https://doi.org/10.1530/ERC-22-0061>.
710. Juhlin CC. On the Chopping Block: Overview of DICER1 Mutations in Endocrine and Neuroendocrine Neoplasms. *Surg Pathol Clin.* 2023;16:107-118. <https://doi.org/10.1016/j.path.2022.09.010>.

711. Goldner WS, Angell TE, McAdoo SL, Babiarz J, Sadow PM, Nabhan FA, et al. Molecular Variants and Their Risks for Malignancy in Cytologically Indeterminate Thyroid Nodules. *Thyroid*. 2019;29:1594-1605. <https://doi.org/10.1089/thy.2019.0278>.
712. Hu MI, Waguespack SG, Dosiou C, Ladenson PW, Livhits MJ, Wirth LJ, et al. Afirma Genomic Sequencing Classifier and Xpression Atlas Molecular Findings in Consecutive Bethesda III-VI Thyroid Nodules. *The Journal of clinical endocrinology and metabolism*. 2021;106:2198-2207. <https://doi.org/10.1210/clinem/dgab304>.
713. Alohalí S, Payne AE, Pusztaszeri M, Rajab M, Forest VI, Hier MP, et al. Effect of Having Concurrent Mutations on the Degree of Aggressiveness in Patients with Thyroid Cancer Positive for TERT Promoter Mutations. *Cancers (Basel)*. 2023;15. <https://doi.org/10.3390/cancers15020413>.
714. Pozdeyev N, Gay LM, Sokol ES, Hartmaier R, Deaver KE, Davis S, et al. Genetic Analysis of 779 Advanced Differentiated and Anaplastic Thyroid Cancers. *Clinical cancer research*. 2018;24:3059-3068. <https://doi.org/10.1158/1078-0432.CCR-18-0373>.
715. Hernandez-Prera JC, Valderrabano P, Creed JH, de la Iglesia JV, Slebos RJC, Centeno BA, et al. Molecular Determinants of Thyroid Nodules with Indeterminate Cytology and RAS Mutations. *Thyroid*. 2021;31:36-49. <https://doi.org/10.1089/thy.2019.0650>.
716. Murugan AK, Dong J, Xie J, Xing M. Uncommon GNAQ, MMP8, AKT3, EGFR, and PIK3R1 mutations in thyroid cancers. *Endocrine pathology*. 2011;22:97-102. <https://doi.org/10.1007/s12022-011-9155-x>.
717. Ferru A, Fromont G, Gibelin H, Guilhot J, Savagner F, Tourani JM, et al. The status of CDKN2A alpha (p16INK4A) and beta (p14ARF) transcripts in thyroid tumour progression. *British journal of cancer*. 2006;95:1670-1677. <https://doi.org/10.1038/sj.bjc.6603479>.
718. de Koster EJ, Husson O, van Dam E, Mijnhout GS, Netea-Maier RT, Oyen WJG, et al. Health-related quality of life following FDG-PET/CT for cytological indeterminate thyroid nodules. *Endocr Connect*. 2022;11:e220014. <https://doi.org/10.1530/EC-22-0014>.
719. Fazeli SR, Zehr B, Amraei R, Toraldo G, Guan H, Kindelberger D, et al. ThyroSeq v2 Testing: Impact on Cytologic Diagnosis, Management, and Cost of Care in Patients with Thyroid Nodule. *Thyroid*. 2020;30:1528-1534. <https://doi.org/10.1089/thy.2019.0191>.
720. Figge JJ, Gooding WE, Steward DL, Yip L, Sippel RS, Yang SP, et al. Do Ultrasound Patterns and Clinical Parameters Inform the Probability of Thyroid Cancer Predicted by Molecular Testing in Nodules with Indeterminate Cytology? *Thyroid*. 2021. <https://doi.org/10.1089/thy.2021.0119>.
721. Zhu Y, Li Y, Jung CK, Song DE, Hang JF, Liu Z, et al. Histopathologic Assessment of Capsular Invasion in Follicular Thyroid Neoplasms-an Observer Variation Study. *Endocrine pathology*. 2020;31:132-140. <https://doi.org/10.1007/s12022-020-09620-7>.
722. Craig S, Khalil M, Eszlinger M, Itani D, Koebel M, Koro K, et al. Malignancy is in the eye of the beholder: Pathologic diagnosis of challenging follicular neoplasms in the era of noninvasive follicular thyroid neoplasms with papillary-like nuclear features and immunohistochemical and molecular adjuncts. *Surgery*. 2021;169:22-26. <https://doi.org/10.1016/j.surg.2020.04.004>.
723. Valderrabano P, Khazai L, Leon ME, Thompson ZJ, Ma Z, Chung CH, et al. Evaluation of ThyroSeq v2 performance in thyroid nodules with indeterminate cytology. *Endocrine-related cancer*. 2017;24:127-136. <https://doi.org/10.1530/erc-16-0512>.
724. Rivas AM, Nassar A, Zhang J, Casler JD, Chindris AM, Smallridge R, et al. ThyroSeq((R))V2.0 Molecular Testing: A Cost-Effective Approach for the Evaluation of Indeterminate Thyroid Nodules. *Endocrine practice*. 2018;24:780-788. <https://doi.org/10.4158/EP-2018-0212>.
725. de Koster EJ, Morreau H, Bleumink GS, van Engen-van Grunsven ACH, de Geus-Oei LF, Links TP, et al. Molecular Diagnostics and [(18)F]FDG-PET/CT in Indeterminate Thyroid Nodules: Complementing Techniques or Waste of Valuable Resources? *Thyroid*. 2024;34:41-53. <https://doi.org/10.1089/thy.2023.0337>.
726. Thuillier P, Ansquer C, Borson-Chazot F, Lussey-Lepoutre C. Response to De Koster and al. Thuillier P, Benisvy D, Ansquer C, Corvilain B, Mirallie E, Taieb D, et al.: What is the role of functional imaging and isotopic treatment? *Ann Endocrinol (Paris)* 2022. <https://doi.org/10.1016/j.ando.2022.10.008>. *Ann Endocrinol (Paris)*. 2023;84:327-328. <https://doi.org/10.1016/j.ando.2023.01.002>.
727. Kreissl MC, Ovaricek PP, Campenni A, Vrachimis A, Tuncel M, Giovanella L. The European Association of Nuclear Medicine (EANM)'s Response to the 2023 European Thyroid Association (ETA) clinical practice guidelines for thyroid nodule management and nuclear medicine: a deliberate oversight? *Eur J Nucl Med Mol Imaging*. 2024. <https://doi.org/10.1007/s00259-023-06571-z>.
728. Partridge L, Deelen J, Slagboom PE. Facing up to the global challenges of ageing. *Nature*. 2018;561:45-56. <https://doi.org/10.1038/s41586-018-0457-8>.
729. Central Bureau for Statistics. Ouderen. 2023. <https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/leeftijd/ouderen>. Accessed 20 November 2023.
730. National Health Care Institute (Zorginstituut Nederland). Verdiepende analyses zorglasten Zvw 2016-2020. 2021. <https://zorginstituutnederland.nl/financiering/publicaties/rapport/2021/12/07/verdiepende-analyses-zorglasten-zvw-2016-2020>. Accessed 20 November 2023.

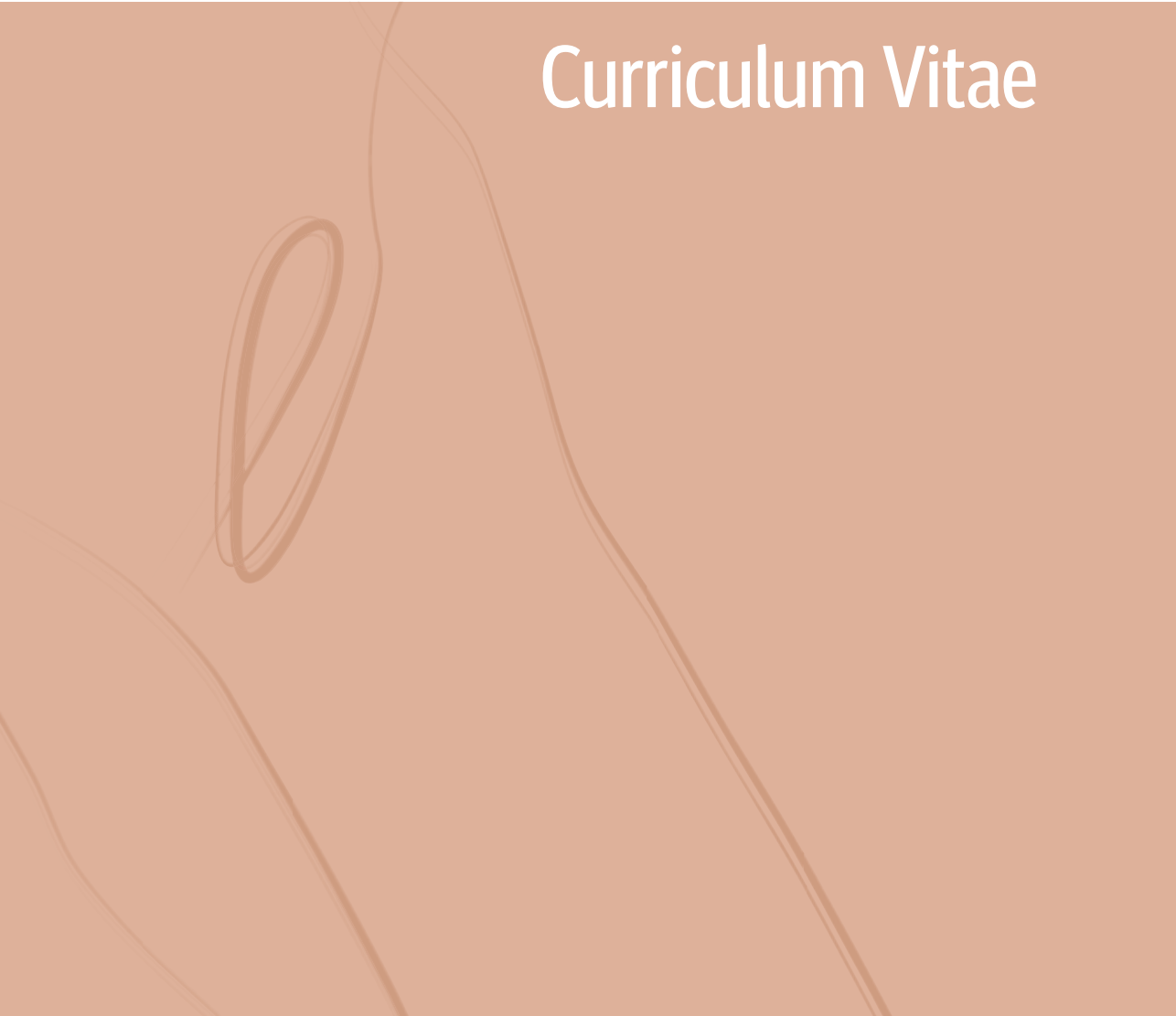
731. Moses H, 3rd, Matheson DH, Dorsey ER, George BP, Sadoff D, Yoshimura S. The anatomy of health care in the United States. *JAMA*. 2013;310:1947-1963. <https://doi.org/10.1001/jama.2013.281425>.
732. de Vries N, Boone A, Godderis L, Bouman J, Szemik S, Matranga D, et al. The Race to Retain Healthcare Workers: A Systematic Review on Factors that Impact Retention of Nurses and Physicians in Hospitals. *Inquiry*. 2023;60:469580231159318. <https://doi.org/10.1177/00469580231159318>.
733. Ministry of Health Welfare and Sport. Integraal Zorgakkoord. <https://www.dejuistezorgopdejuisteplek.nl/>. Accessed 4 December 2023.
734. Lubitz CC, Kong CY, McMahon PM, Daniels GH, Chen Y, Economopoulos KP, et al. Annual financial impact of well-differentiated thyroid cancer care in the United States. *Cancer*. 2014;120:1345-1352. <https://doi.org/10.1002/cncr.28562>.
735. Kluijfhout WP, Pasternak JD, Lim J, Kwon JS, Vriens MR, Clark OH, et al. Frequency of High-Risk Characteristics Requiring Total Thyroidectomy for 1-4 cm Well-Differentiated Thyroid Cancer. *Thyroid : official journal of the American Thyroid Association*. 2016;26:820-824. <https://doi.org/10.1089/thy.2015.0495>.
736. Dhir M, McCoy KL, Ohori NP, Adkisson CD, LeBeau SO, Carty SE, et al. Correct extent of thyroidectomy is poorly predicted preoperatively by the guidelines of the American Thyroid Association for low and intermediate risk thyroid cancers.
737. Worrall BJ, Papachristos AA-O, Aniss A, Glover A, Sidhu SB, Clifton-Bligh RA-O, et al. Lobectomy and completion thyroidectomy rates increase after the 2015 American Thyroid Association Differentiated Thyroid Cancer Guidelines update. *Endocr Oncol*. 2023;3:e220095. <https://doi.org/10.1530/EO-22-0095>
738. Tang AL, Kloos RT, Aunins B, Holm TM, Roth MY, Yeh MW, et al. Pathologic Features Associated With Molecular Subtypes of Well-Differentiated Thyroid Cancer. *Endocrine practice*. 2021;27:206-211. <https://doi.org/10.1016/j.eprac.2020.09.003>.
739. Semsar-Kazerooni K, Morand GB, Payne AE, da Silva SD, Forest VI, Hier MP, et al. Mutational status may supersede tumor size in predicting the presence of aggressive pathologic features in well differentiated thyroid cancer. *Journal of otolaryngology - head & neck surgery*. 2022;51:9. <https://doi.org/10.1186/s40463-022-00559-9>.
740. Morand GB, Tessler I, Noik M, Krasner J, Yamin T, Pusztaszeri MP, et al. Molecular Profiling for Bethesda III to VI Nodules: Results of a Multicenter International Retrospective Study. *Endocrine practice : official journal of the American College of Endocrinology and the American Association of Clinical Endocrinologists*. 2024. <https://doi.org/10.1016/j.eprac.2024.01.002>.
741. Barnes AB, Justice-Clark T, Li W, Randle RW. Molecular Testing for Indeterminate Thyroid Nodules: Association of Negative Predictive Value With Nodule Size. *The American surgeon*. 2022;88:2745-2751. <https://doi.org/10.1177/00031348221109489>.
742. Schenke SA, Campenni A, Tuncel M, Bottoni G, Sager S, Bogovic Crncic T, et al. Diagnostic Performance of (99m)Tc-Methoxy-Isobuty-Isonitrile (MIBI) for Risk Stratification of Hypofunctioning Thyroid Nodules: A European Multicenter Study. *Diagnostics*. 2022;12. <https://doi.org/10.3390/diagnostics12061358>.
743. Tuttle RM, Fagin JA, Minkowitz G, Wong RJ, Roman B, Patel S, et al. Natural History and Tumor Volume Kinetics of Papillary Thyroid Cancers During Active Surveillance. *JAMA otolaryngology - head & neck surgery*. 2017;143:1015-1020. <https://doi.org/10.1001/jamaoto.2017.1442>.
744. Saravana-Bawan B, Bajwa A, Paterson J, McMullen T. Active surveillance of low-risk papillary thyroid cancer: A meta-analysis. *Surgery*. 2020;167:46-55. <https://doi.org/10.1016/j.surg.2019.03.040>.
745. Vuong HG, Le HT, Le TTB, Le T, Hassell L, Kakudo K. Clinicopathological significance of major fusion oncogenes in papillary thyroid carcinoma: An individual patient data meta-analysis. *Pathology, research and practice*. 2022;240:154180. <https://doi.org/10.1016/j.prp.2022.154180>.
746. McCoy KL, Jabbour N, Ogilvie JB, Ohori NP, Carty SE, Yim JH. The incidence of cancer and rate of false-negative cytology in thyroid nodules greater than or equal to 4 cm in size. *Surgery*. 2007;142:837-844; discussion 844 e831-833. <https://doi.org/10.1016/j.surg.2007.08.012>.
747. Kizilgul M, Shrestha R, Radulescu A, Evasovich MR, Burmeister LA. Thyroid nodules over 4 cm do not have higher malignancy or benign cytology false-negative rates. *Endocrine*. 2019;66:249-253. <https://doi.org/10.1007/s12020-019-01964-3>.
748. Baynes J, Dominiczak MH. *Medical Biochemistry*, second edition: Elsevier Mosby; 2004.
749. Elsheikh TM, Asa SL, Chan JK, DeLellis RA, Heffess CS, LiVolsi VA, et al. Interobserver and intraobserver variation among experts in the diagnosis of thyroid follicular lesions with borderline nuclear features of papillary carcinoma. *American journal of clinical pathology*. 2008;130:736-744. <https://doi.org/10.1309/AJCPKP2QUVN4RCCP>.
750. Rossi ED, Faquin WC, Pantanowitz L. Cytologic features of aggressive variants of follicular-derived thyroid carcinoma. *Cancer cytopathology*. 2019;127:432-446. <https://doi.org/10.1002/cncy.22136>.
751. Ohori NP, Landau MS, Manroa P, Schoedel KE, Seethala RR. Molecular-derived estimation of risk of malignancy for indeterminate thyroid cytology diagnoses. *J Am Soc Cytopathol*. 2020;9:213-220. <https://doi.org/10.1016/j.jasc.2020.03.004>.

752. Patel KN, Angell TE, Babiarz J, Barth NM, Blevins T, Duh QY, et al. Performance of a Genomic Sequencing Classifier for the Preoperative Diagnosis of Cytologically Indeterminate Thyroid Nodules. *JAMA Surg.* 2018;153:817-824. <https://doi.org/10.1001/jamasurg.2018.1153>.
753. Schatz-Siemers N, Brandler TC, Oweity T, Sun W, Hernandez A, Levine P. Hurthle cell lesions on thyroid fine needle aspiration cytology: Molecular and histologic correlation. *Diagnostic cytopathology.* 2019. <https://doi.org/10.1002/dc.24247>.
754. Morani F, Phadngam S, Follo C, Titone R, Aimaretti G, Galetto A, et al. PTEN regulates plasma membrane expression of glucose transporter 1 and glucose uptake in thyroid cancer cells. *J Mol Endocrinol.* 2014;53:247-258. <https://doi.org/10.1530/JME-14-0118>.
755. de Koster EJ, de Geus-Oei LF, Oyen WJG, Vriens D. In reaction to: Thuillier P, Benisvy D, Ansquer C, Corvilain B, Mirallie E, Taieb D, et al. Section 5: What is the role of functional imaging and isotopic treatment? *Ann Endocrinol (Paris)* 2022;83:401-6. <https://doi.org/10.1016/j.ando.2022.10.008>. *Ann Endocrinol (Paris).* 2023;84:325-326. <https://doi.org/10.1016/j.ando.2022.12.002>.
756. San Martin VT, Lawrence L, Bena J, Madhun NZ, Berber E, Elsheikh TM, et al. Real World Comparison of Afirma GEC and GSC for the Assessment of Cytologically Indeterminate Thyroid Nodules. *The Journal of clinical endocrinology and metabolism.* 2019. <https://doi.org/10.1210/clinem/dgz099>.
757. Kim NE, Raghunathan RS, Hughes EG, Longstaff XR, Tseng CH, Li S, et al. Bethesda III and IV Thyroid Nodules Managed Nonoperatively after Molecular Testing with Afirma GSC or Thyroseq v3. *The Journal of clinical endocrinology and metabolism.* 2023. <https://doi.org/10.1210/clinem/dgad181>.
758. Zhu CY, Donangelo I, Gupta D, Nguyen DT, Ochoa JE, Yeh MW, et al. Outcomes of Indeterminate Thyroid Nodules Managed Nonoperatively after Molecular Testing. *The Journal of clinical endocrinology and metabolism.* 2021;106:e1240-e1247. <https://doi.org/10.1210/clinem/dgaa887>.
759. Schunemann HJ, Oxman AD, Brozek J, Glasziou P, Jaeschke R, Vist GE, et al. Grading quality of evidence and strength of recommendations for diagnostic tests and strategies. *Bmj.* 2008;336:1106-1110. <https://doi.org/10.1136/bmj.39500.677199.AE>.
760. Siontis KC, Siontis GC, Contopoulos-loannidis DG, Ioannidis JP. Diagnostic tests often fail to lead to changes in patient outcomes. *J Clin Epidemiol.* 2014;67:612-621. <https://doi.org/10.1016/j.jclinepi.2013.12.008>.
761. Ferrante di Ruffano L, Davenport C, Eisinga A, Hyde C, Deeks JJ. A capture-recapture analysis demonstrated that randomized controlled trials evaluating the impact of diagnostic tests on patient outcomes are rare. *J Clin Epidemiol.* 2012;65:282-287. <https://doi.org/10.1016/j.jclinepi.2011.07.003>.
762. Ferrante di Ruffano L, Dinnes J, Taylor-Phillips S, Davenport C, Hyde C, Deeks JJ. Research waste in diagnostic trials: a methods review evaluating the reporting of test-treatment interventions. *BMC medical research methodology.* 2017;17:32. <https://doi.org/10.1186/s12874-016-0286-0>.
763. Tuut MK, Burgers JS, van der Weijden T, Langendam MW. Do clinical practice guidelines consider evidence about diagnostic test consequences on patient-relevant outcomes? A critical document analysis. *J Eval Clin Pract.* 2022;28:278-287. <https://doi.org/10.1111/jep.13619>.
764. Valk PE. Randomized controlled trials are not appropriate for imaging technology evaluation. *Journal of nuclear medicine.* 2000;41:1125-1126.
765. Lijmer JG, Bossuyt PM. Various randomized designs can be used to evaluate medical tests. *J Clin Epidemiol.* 2009;62:364-373. <https://doi.org/10.1016/j.jclinepi.2008.06.017>.
766. Van den Bruel A, Cleemput I, Aertgeerts B, Ramaekers D, Buntinx F. The evaluation of diagnostic tests: evidence on technical and diagnostic accuracy, impact on patient outcome and cost-effectiveness is needed. *J Clin Epidemiol.* 2007;60:1116-1122. <https://doi.org/10.1016/j.jclinepi.2007.03.015>.
767. Central Bureau for Statistics. Steeds meer hoogopgeleiden in Nederland: wat voor beroep hebben ze? 2022. <https://www.cbs.nl/nl-nl/longread/statistische-trends/2022/steeds-meer-hoogopgeleiden-in-nederland-wat-voor-beroep-hebben-ze?onepage=true>. Accessed 30 November 2023.
768. Ferrante di Ruffano L, Hyde CJ, McCaffery KJ, Bossuyt PM, Deeks JJ. Assessing the value of diagnostic tests: a framework for designing and evaluating trials. *BMJ.* 2012;344:e686. <https://doi.org/10.1136/bmj.e686>.
769. Cox K. Enhancing cancer clinical trial management: recommendations from a qualitative study of trial participants' experiences. *Psychooncology.* 2000;9:314-322. [https://doi.org/10.1002/1099-1611\(200007/08\)9:4<314::aid-pon464>3.0.co;2-c](https://doi.org/10.1002/1099-1611(200007/08)9:4<314::aid-pon464>3.0.co;2-c).
770. Henderson GE, Churchill LR, Davis AM, Easter MM, Grady C, Joffe S, et al. Clinical trials and medical care: defining the therapeutic misconception. *PLoS Med.* 2007;4:e324. <https://doi.org/10.1371/journal.pmed.0040324>.
771. Cohen MZ, Slomka J, Pentz RD, Flamm AL, Gold D, Herbst RS, et al. Phase I participants' views of quality of life and trial participation burdens. *Support Care Cancer.* 2007;15:885-890. <https://doi.org/10.1007/s00520-007-0216-0>.
772. Horng S, Grady C. Misunderstanding in clinical research: distinguishing therapeutic misconception, therapeutic misestimation, and therapeutic optimism. *IRB.* 2003;25:11-16.

773. Lidz CW, Appelbaum PS. The therapeutic misconception: problems and solutions. *Med Care*. 2002;40:V55-63. <https://doi.org/10.1097/01.MLR.0000023956.25813.18>.
774. Masiye F, Mayosi B, de Vries J. "I passed the test!" Evidence of diagnostic misconception in the recruitment of population controls for an H3Africa genomic study in Cape Town, South Africa. *BMC Med Ethics*. 2017;18:12. <https://doi.org/10.1186/s12910-017-0175-z>.
775. Nobile H, Vermeulen E, Thys K, Bergmann MM, Borry P. Why do participants enroll in population biobank studies? A systematic literature review. *Expert Rev Mol Diagn*. 2013;13:35-47. <https://doi.org/10.1586/erm.12.116>.
776. Sharma D, Aggarwal AK, Downey LE, Prinja S. National Healthcare Economic Evaluation Guidelines: A Cross-Country Comparison. *Pharmacoecon Open*. 2021;5:349-364. <https://doi.org/10.1007/s41669-020-00250-7>.
777. Kanters TA, Bouwmans CAM, van der Linden N, Tan SS, Hakkaart-van Roijen L. Update of the Dutch manual for costing studies in health care. *PLoS one*. 2017;12:e0187477. <https://doi.org/10.1371/journal.pone.0187477>.
778. Ross JS. Clinical research data sharing: what an open science world means for researchers involved in evidence synthesis. *Syst Rev*. 2016;5:159. <https://doi.org/10.1186/s13643-016-0334-1>.



Curriculum Vitae

The background of the lower half of the page is a solid orange color. Overlaid on this background is white line art. On the left side, there is a large, stylized letter 'P'. To the right of the 'P', there is a faint, white line drawing of a person's profile, facing right. The profile includes the head, neck, and shoulders, with some internal lines suggesting facial features and clothing.

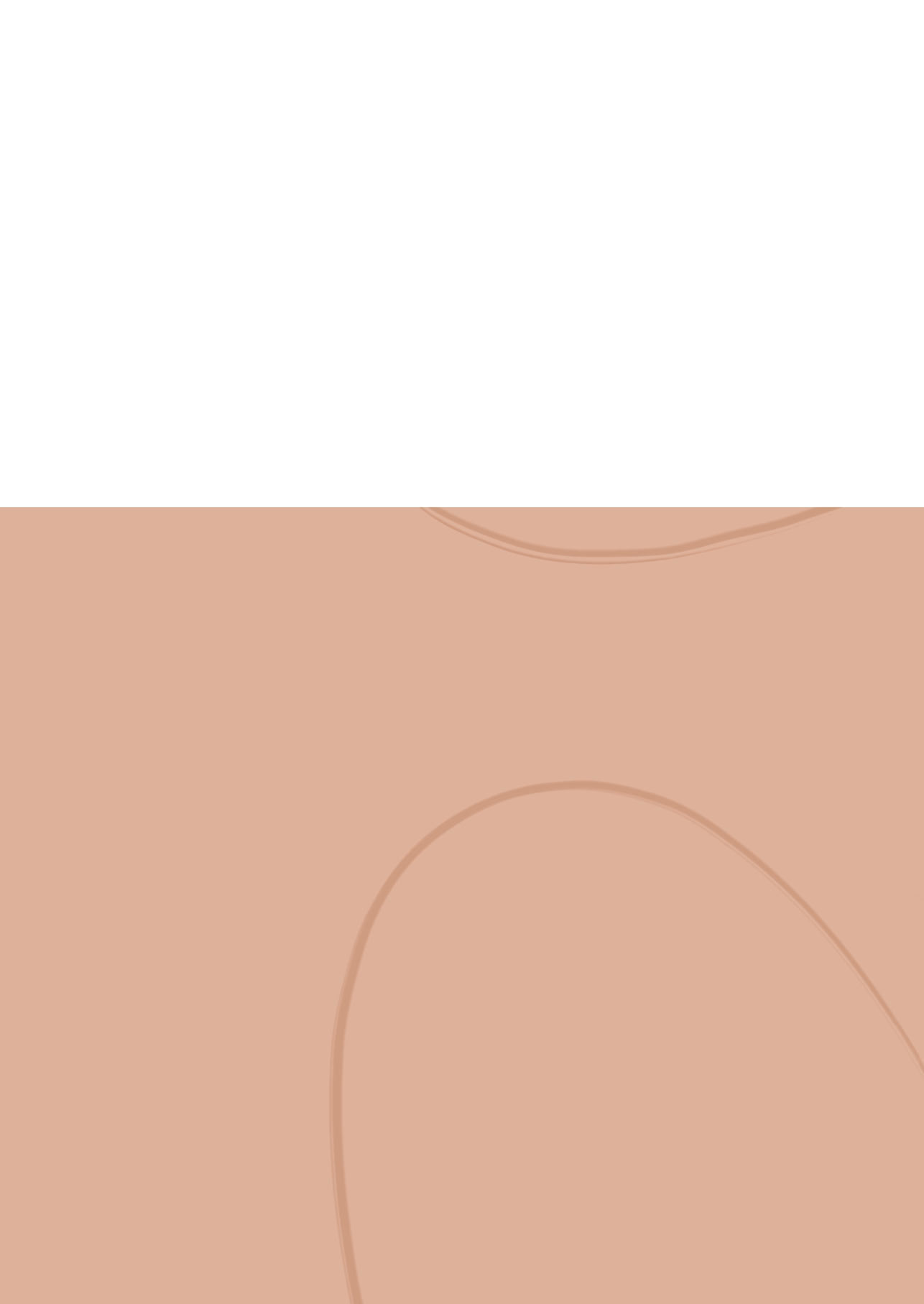
Curriculum Vitae

Elizabeth Janna (Lisanne) de Koster was born on the 25th of July 1988 and grew up in Hoedekenskerke, Zeeland, the Netherlands. After graduating cum laude from the Gymnasium at the Buys Ballot College, Goes, in 2006, she studied taal- en cultuurstudies at the University of Utrecht for one year before starting her medical education at the University of Utrecht in 2007. During her bachelor studies, she became actively involved in the medical student association MSFU “Sams” and during her master studies, she fulfilled a fulltime board position in 2011-2012 as treasurer. Subsequently, during the medicine master’s program, she started an extracurricular research project on the factors influencing the nondiagnostic rate of thyroid fine needle aspiration cytology at the departments of surgical oncology and radiology at the University Medical Center Utrecht, Utrecht. She also visited the Tygerberg hospital at the University of Stellenbosch, Cape Town, South Africa, for a clinical internship in general surgery.

In 2015, Lisanne obtained her medical degree and started her PhD research at the Radboud University Medical Center, Nijmegen. Under the supervision of prof. dr. Lioe-Fee de Geus-Oei, prof. dr. Wim Oyen, and dr. Dennis Vriens, she coordinated the EFFECTS trial, the Dutch multicenter randomized controlled trial on the efficacy of [¹⁸F]FDG-PET/CT in the diagnosis of cytologically indeterminate thyroid nodules that is the basis of this thesis. During her PhD research, she held a parttime position as board member for the LUMC Association for PhD Candidates as treasurer.

To bridge the gap to enroll the desired number of trial participants in the EFFECTS trial, she concurrently worked as a surgical resident (not-in-training) at the St. Antonius Hospital, Nieuwegein, from April 2017 to June 2018. Since July 2018, she is working as a surgical resident in training at the Haaglanden Medical Center, the Hague. She aspires to become a trauma surgeon with an additional qualification for pediatric surgery.

Lisanne currently lives in Leiden with her partner Mathijs and their children Boaz and Lauren.



List of publications

List of publications

EJ de Koster, H Morreau, GS Bleumink, ACH van Engen-van Grunsven, LF de Geus-Oei, TP Links, IMMJ Wakelkamp, WJG Oyen, D Vriens. [¹⁸F]FDG-PET/CT and molecular diagnostics in indeterminate thyroid nodules: complementing techniques or waste of valuable resources? *Thyroid*. 2024 Jan;34(1):41-53.

EJ de Koster, WE Corver, LF de Geus-Oei, WJG Oyen, D Ruano, A Schepers, M Snel, T van Wezel, D Vriens, H Morreau. A clinically applicable molecular classification of Hürthle cell thyroid nodules. *Endocr Relat Cancer*. 2023 Aug 3;30(9):e230047.

G Rovera, **EJ de Koster**, V Rufini, M Zollino, L Zagaria, F Giammarile, S Vidal-Sicart, R Valdés Olmos, A Collarino. ^{99m}Tc-Tilmanocept performance for sentinel node mapping in breast cancer, melanoma, and head and neck cancer: a systematic review and meta-analysis from a European expert panel. *EJNMMI. Eur J Nucl Med Mol Imaging*. 2023 Sep;50(11):3375-3389.

A Collarino, V Fuoco, G Garganese, T Pasciuto, **EJ de Koster**, A Florit, SM Fragomeni, L Zagaria, A Fragano, F Martinelli, A Ditto, E Seregni, G Scambia, F Raspagliesi, V Ruffini, M Maccauro. Lymphatic Mapping and Sentinel Node Biopsy in Vulvar Melanoma: the first multicenter study and systematic review. *Gynecol Oncol*. 2023 Mar; 170:153-159.

D Vriens, **EJ de Koster**, LF de Geus-Oei, WJG Oyen. Preoperative stratification of cytologically indeterminate thyroid nodules by [¹⁸F]FDG-PET: can Orpheus bring back Eurydice? *Eur J Nucl Med Mol Imaging*. 2023 Mar;50(4):975-979

EJ de Koster, LF de Geus-Oei, WJG Oyen, Vriens. In reaction to: Thuillier P et al. Section 5: What is the role of functional imaging and isotopic treatment? *Ann Endocrinol (Paris)* 2022. *Ann Endocrinol (Paris)*. 2023 Apr;84(2):325-326.

EJ de Koster, ACH van Engen-van Grunsven, J Bussink, C Frielink, LF de Geus-Oei, B Kusters, H Peters, WJG Oyen, D Vriens. [¹⁸F]FDG Uptake and Expression of Immunohistochemical Markers Related to Glycolysis, Hypoxia, and Proliferation in Indeterminate Thyroid Nodules. *Mol Imaging Biol*. 2023 Jun;25(3):483-494.

WA Noortman, **EJ de Koster**, FHP van Velden, LF de Geus-Oei, D Vriens. Non-invasive imaging biomarkers of thyroid nodules with indeterminate cytology. Published in: Luca Giovanella, editors. *Integrated Diagnostics and Theranostics of Thyroid Diseases*. Springer International Publishing; 2023. ISBN 9783031352133

EJ de Koster, D Vriens, MO van Aken, LT Dijkhorst-Oei, WJG Oyen, RP Peeters, A Schepers, LF de Geus-Oei, WB van den Hout. FDG-PET/CT in indeterminate thyroid nodules: cost-utility analysis alongside a randomised controlled trial. *EJNMMI*. 2022 Aug;49(10):3452-3469.

EJ de Koster, O Husson, EWCM van Dam, GS Mijnhout, RT Netea-Maier, WJG Oyen, M Snel, LF de Geus-Oei, D Vriens. Health-related quality of life following FDG-PET/CT for cytological indeterminate thyroid nodules. *Endocr Connect*. 2022 Jul 19;11(8):e220014.

EJ de Koster, WA Noortman, JM Mostert, J Booij, CB Brouwer, B de Keizer, JMH de Klerk, WJG Oyen, FHP van Velden, LF de Geus-Oei, D Vriens. Quantitative classification and radiomics of [¹⁸F]FDG-PET/CT in indeterminate thyroid nodules. *EJNMMI*. 2022 Jun;49(7):2174-2188.

EJ de Koster, LF de Geus-Oei, AH Brouwers, EWCM van Dam, LT Dijkhorst-Oei, ACH van Engen-van Grunsven, WB van den Hout, TK Klooker, RT Netea-Maier, M Snel, WJG Oyen, D Vriens. [¹⁸F]FDG-PET/CT to prevent futile surgery in indeterminate thyroid nodules: a blinded, randomised controlled multicentre trial. *EJNMMI*. 2022 May;49(6):1970-1984.

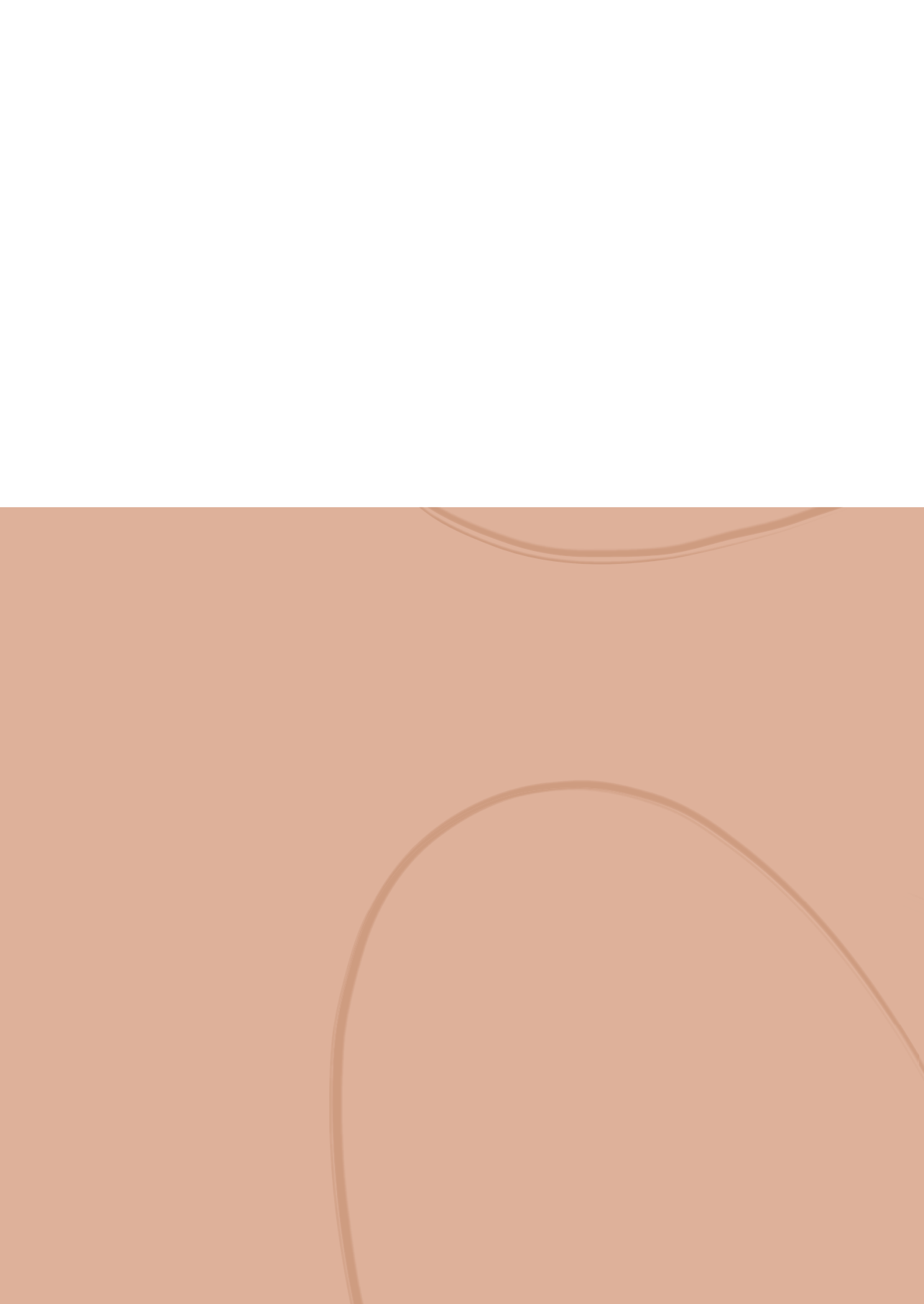
EJ de Koster, T Sulaiman, JF Hamming, A Schepers, M Snel, FHP van Velden, LF de Geus-Oei, D Vriens. Radioiodine in Differentiated Thyroid Carcinoma: Do We Need Diagnostic Pre-Ablation Iodine-123 Scintigraphy to Optimize Treatment? *Diagnostics* 2021, 11, 553.

EKA Triumbari, **EJ de Koster**, V Rufini, SM Fragomeni, G Garganese, A Collarino. ¹⁸F-FDG PET and ¹⁸F-FDG PET/CT in Vulvar Cancer: A Systematic Review and Meta-analysis. *Clin Nucl Med*. 2021 Feb 1;46(2):125-132.

EJ de Koster, LF de Geus-Oei, OM Dekkers, I Engen-van Grunsven, JF Hamming, EPM Corssmit, H Morreau, A Schepers, J Smit, WJG Oyen, D Vriens. Diagnostic Utility of Molecular and Imaging Biomarkers in Cytological Indeterminate Thyroid Nodules. *Endocr Rev*. 2018 Apr 1;39(2):154-191.

A Collarino, **EJ de Koster**, RA Valdes Olmos, LF de Geus-Oei, LM Pereira Arias-Bouda. Is 99mTc-sestamibi Imaging Able to Predict Pathologic Nonresponse to Neoadjuvant Chemotherapy in Breast Cancer? A Meta-analysis Evaluating Current Use and Shortcomings. *Clin Breast Cancer*. 2018 Feb;18(1):9-18.

EJ de Koster, JW Kist, MR Vriens, IH Borel Rinkes, GD Valk, B de Keizer. Thyroid ultrasound-guided fine needle aspiration: the positive influence of on-site adequacy assessment and number of needle passes on diagnostic cytology rate. *Acta Cytol*. 2016;60(1):39-45.

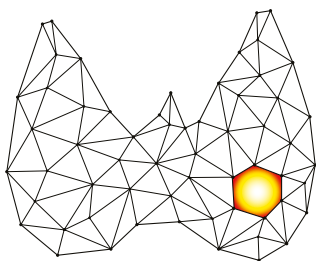


Acknowledgements

The background of the lower half of the page is a solid orange color. Overlaid on this background is white line art. On the left side, there is a circular shape with a double outline, resembling a stylized 'e' or a loop. To the right of this, there are several long, curved lines that sweep across the page, suggesting the profile of a person's head and neck in a minimalist, sketch-like style.

Dankwoord

Om privacyredenen is het dankwoord alleen te lezen in de papieren versie van dit proefschrift.



EfFECTS