

# Multiple Endokrin Neoplaziler

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## Ana Konular

- Giriş
- Çoklu Endokrin Neoplazi Tip 1
- Çoklu Endokrin Neoplazi Tip 2
- Çoklu Endokrin Neoplazi Tip 4

## GİRİŞ

Multiple endokrin neoplaziler (MEN) vücudun endokrin sistemini etkileyen bir grup bozukluk olup tek bir hastada iki veya daha fazla endokrin bezi tutan tümörler ile karakterizedir. Bu tümörler iyi huylu (benign) veya kötü huylu (malign) olabilirler. Bu bozukluk daha önce “çoklu endokrin bez adenopatisi” ve “pluriglandüler sendrom” olarak adlandırılmış olup günümüzde ise MEN isimlendirilmesi tercih edilmektedir.

Dört majör MEN tipi vardır: Tip 1 (MEN-1, Wermer sendromu) ve Tip 2 (TİP 2 A, MEN-2A, Sipple's sendromu), Tip 3 (MEN-2B veya diğer adıyla MEN Tip 2B) ve Tip 4 (MEN-4).

Her bir form, spesifik endokrin bezlerde tümör gelişimi ile karakterizedir. MEN sendromlarının klinik belirtileri, tümörlerin bölgeleri ve salgı ürünleri ile ilişkilidir. Her bir tümörün tanısı ve yönetimi, MEN olmayan hastalardakine benzerdir. Tüm MEN tipleri genellikle otozomal dominant kalıtım gösterirler. MEN sendromunda her bir fenotipi diktelenen ve dolayısıyla bu bozukluklarla ilişkili çeşitli anormalliliklere yol açan çoklu olası kodon değişiklikleri vardır.

## MULTIPLE ENDOKRİN NEOPLAZİ TİP 1

### Tanımı

MEN-1 otozomal dominant kalıtım gösteren bir bozukluktur ve 100.000'de 2-3'lük bir prevalansa sahiptir. Otopsi serilerinde görülme sıklığı %0.22-0.25 civarındadır. MEN-1'e neden olan gen, kromozom 11'in (11q13) uzun kolunda yer alır ve 10 eksandan (9 kodlama) oluşan suppressör bir gendir. Sporadik veya ailesel formu vardır. MEN-1 sendromunun özelliklerine sahip, ancak aile öyküsü olmayan hastalar, MEN-1'in sporadik formunu oluşturur. MEN-1 olan hastalar belirli coğrafi bölgeye ait değildir. Irksal veya etnik yatırımları yoktur. Oluşumunda rol alan herhangi bir risk faktörü bilinmemektedir.

MEN-1 sendromu ile ortaya çıkan 20'den fazla (endokrin sistem kaynaklı olan veya olmayan) tümör gelişimi görülebilimekte olup bunlardan sık görülenleri; anjiyofibromlar (%88), kolajenomlar (%72), adrenal kortikal tümörler (%35), tiroit adenomalar (%10) ve yüz epandimomlarıdır (<%5). MEN-1, tümör baskılacak geninin germline inaktive edici mutasyonları sonucunda paratiroid bezi (%95), pankreas (%40), hipofiz bezi tümörleri (%30) ile sonuçlanır (**Tablo 1**).

değişikliklere dayanan hastalığa sahiptir. Son zamanlarda, siklin-bağımlı kinaz (CDK) inhibitör geni CDKN1B'deki germline mutasyonlarının, hem insan MEN-1 hem de MEN-2 sendromlarının özeliliklerine sahip farelerde bir MEN-X'e neden olmasından sorumlu olduğu belirlenmiştir. Daha sonra da, MEN-1 gen mutasyonu olmayan MEN-1 özelilikli birçok hastada CDKN1B geninde mutasyon

tarif edilmiştir. MEN-1 ile ilişkilendirilen tümörlerin %3'ünde CDKN1B mutasyonlarına sahip olduğu ortaya konulmuştur. Bugüne kadar, MEN-1 benzeri tümörler bulunan hastalarda 8 farklı heterozigot CDKN1B mutasyonu tanımlanmıştır ve bu durum insanlarda MEN-4'ün, sığanlarda otozomal resesif olan MEN-X'in aksine, otozomal dominant bir bozukluk olduğunu göstermektedir.

## Kaynaklar

- Agarwal SK. (2014). Exploring the tumors of multiple endocrine neoplasia type 1 in mouse models for basic and preclinical studies. *International Journal of Endocrine Oncology*, 1, 153–161. doi:10.2217/ije.14.16
- Agarwal SK, Mateo CM, Marx SJ. (2009). Rare germline mutations in cyclin-dependent kinase inhibitor genes in multiple endocrine neoplasia type 1 and related states. *J Clin Endocrinol Metab*, 94(5), 1826–1834. doi: 10.1210/jc.2008-2083
- Alexander HRN, Bartlett DL, Tio L, Benjamin SB, Doppman JL, Goebel SU, Serrano J, Gibril F, Jensen RT. (1998). Prospective study of somatostatin receptor scintigraphy and its effect on operative outcome in patients with Zollinger-Ellison syndrome. *Annals of Surgery*, 228, 228–238. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1191465/pdf/annsurg00006-0100.pdf>
- Angeli E, Vanzulli A, Castrucci M, Venturini M., Sironi S., Zerbi A. (1997). Value of abdominal sonography and MR imaging at 0.5 T in preoperative detection of pancreatic insulinoma: a comparison with dynamic CT and angiography. *Abdominal Imaging*, 22, 295–303. doi: org/10.1007/s002619900193
- Anlauf M, Perren A, Kloppel G. (2007). Endocrine precursor lesions and microadenomas of the duodenum and pancreas with and without MEN1: criteria, molecular concepts and clinical significance. *Pathobiology*, 74, 279–284. doi:10.1159/000105810
- Brandi ML, Marx SJ, Aurbach GD, Fitzpatrick LA. (1987). Familial multiple endocrine neoplasia type I: a new look at pathophysiology. *Endocrine Reviews*, 8, 391–405. doi:10.1210/edrv-8-4-391
- Benya RV, Metz DC, Venzon DJ, Fishbeyn VA, Strader DB, Orbuch M, Jensen RT. (1994). Zollinger-Ellison syndrome can be the initial endocrine manifestation in patients with multiple endocrine neoplasia-type I. *American Journal of Medicine*, 97, 436–444. doi:10.1016/0002-9343(94)90323-9
- Carney JA, Go VL, Sizemore GW, Hayles AB. (1976). Alimentary-tract ganglioneuromatosis. A major component of the syndrome of multiple endocrine neoplasia, type 2b. *New England Journal of Medicine*, 295, 1287–1291. doi: 10.1056/NEJM197612022952304
- De Laat JM, Pieterman CR, Weijmans M, Hermus AR, Dekkers OM, de Herder WW... (2013). Low accuracy of tumor markers for diagnosing pancreatic neuroendocrine tumors in multiple endocrine neoplasia type 1 patients. *Journal of Clinical Endocrinology and Metabolism*, 98, 4143–4151. doi: 10.1210/jc.2013-1800
- d'Assignies G, Fina P, Bruno O, Vullierme MP, Tubach F, Paradis. (2013). High sensitivity of diffusion-weighted MR imaging for the detection of liver metastases from neuroendocrine tumors: comparison with T2-weighted and dynamic gadolinium-enhanced MR imaging. *Radiology*, 268, 390–9. doi: org/10.1148/radiol.13121628
- Del Prete M, Marotta V, Ramundo V, Marciello F, Di Sarno A, Esposito R... (2013). Impact of cinacalcet hydrochloride in clinical management of primary hyperparathyroidism in multiple endocrine neoplasia type 1. *Minerva Endocrinology*, 38, 389–394. [https://www.minervamedica.it/en/journals/minerva\\_endocrinologica](https://www.minervamedica.it/en/journals/minerva_endocrinologica)
- Del Pozo C, Garcia-Pascual L, Balsells M, Barahona MJ, Veloso E, González C... (2011). Parathyroid carcinoma in multiple endocrine neoplasia type 1. Case report and review of the literature. *Hormones*, 4, 326–331. <http://www.hormones.gr/747/article/article.html>

- E Passaro Jr, Howard TJ, MP Sawicki, Watt PC, Stabile BE. (1998). The Origin of Sporadic Gastrinomas Within the Gastrinoma Triangle. *Archives of Surgery*, 133(1), 13–16. doi:10.1001/archsurg.133.1.13
- Filopanti M, Verga U, Ermetici F, Olgiati L, Eller-Vainicher C, Corbetta S, Persani L... (2012). MEN1-related hyperparathyroidism: response to cinacalcet and its relationship with the calcium-sensing receptor gene variant Arg990Gly. *European Journal of Endocrinology*, 167, 157–164. doi: 10.1530/EJE-12-0117
- Frank-Raue K, Rondot S, Raue F. (2010). Molecular genetics and phenomics of RET mutations: impact on prognosis of MTC. *Molecular Cell Endocrinology*, 322(1–2), 2–7. doi: 10.1016/j.mce.2010.01.012
- Gatta-Cherifi BMA, Niccoli P, Cardot-Bauters C, Rohmer V, Young J, Delemer B. (2012). Adrenal involvement in MEN1. Analysis of 715 cases from the Groupe d'étude des tumeurs endocrines database. *European journal of endocrinology*, 166, 269–272. doi: 10.1530/EJE-11-0679
- Gauger PG, Thompson NW. (2001). Early surgical intervention and strategy in patients with multiple endocrine neoplasia type 1. *Best Pract Res Clin Endocrinol Metab.*, 15(2), 213–223. doi:10.1053/beem.2001.0136
- Gibril F, Venzon DJ, Ojeaburu JV, Bashir S, Jensen RT. (2001). Prospective study of the natural history of gastrinoma in patients with MEN1: Definition of an aggressive and a nonaggressive form. *Journal of Clinical Endocrinology and Metabolism*, 86(11), 5282–5293. doi:10.1210/jcem.86.11.8011
- Giusti F, Cavalli L, Cavalli T, Brandi ML. (2013). Hereditary hyperparathyroidism syndromes. *Journal of Clinical Densitometry*, 16, 69–74. doi: 10.1016/j.jocd.2012.11.003
- Grajo JR, Pasquali RM, Sahani DV, Kambadakone A. (2016). Multiple Endocrine Neoplasia Syndromes. A Comprehensive Imaging Review. *Radiol Clin North America*, 54, 441–51. doi: 10.1016/j.rclin.2015.12.001
- Goudet P, Murat A, Cardot-Bauters C, Emy P, Baudin E, du Boulay Choplin H... (2009). Thymic neuroendocrine tumors in multiple endocrine neoplasia type 1: a comparative study on 21 cases among a series of 761 MEN1 from the GTE (Groupe des Tumeurs Endocrines). *World Journal of Surgery*, 33, 1197–1207. doi: 10.1007/s00268-009-9980-y.
- Howe JR, Norton JA, Wells SA Jr. (1993). Prevalence of pheochromocytoma and hyperparathyroidism in multiple endocrine neoplasia type 2A: results of long-term follow-up. *Surgery*, 114, 1070–77. <https://www.journals.elsevier.com/surgery>.
- Imamura M. (2010). Recent standardization of treatment strategy for pancreatic neuroendocrine tumors. *World Journal of Gastroenterology*, 16, 4519–4525. doi: 10.3748/wjg.v16.i36.4519
- Imamura M, Komoto I, Ota S, Hiratsuka T, Kosugi S, Doi R, Awane M... (2011). Biochemically curative surgery for gastrinoma in multiple endocrine neoplasia type 1 patients. *World Journal of Gastroenterology*, 17, 1343–1353. doi: 10.3748/wjg.v17.i10.1343
- Ito T, Igarashi H, Jensen RT. (2012). Pancreatic neuroendocrine tumors: clinical features, diagnosis and medical treatment: Advances. *Best Practice Research Clinical Gastroenterology*, 26, 737–753. doi: 10.1016/j.bpg.2012.12.003
- Ito T, Igarashi H, Uehara H, Berna MJ, Jensen RT. (2013). Causes of death and prognostic factors in multiple endocrine neoplasia type 1: a prospective study: comparison of 106 MEN1/Zollinger-Ellison syndrome patients with 1613 literature MEN1 patients with or without pancreatic endocrine tumors. *Medicine (Baltimore)*, 92(3), 135–181. doi: 10.1097/MD.0b013e3182954af1
- Jensen RT, Berna M, Bingham MD, Norton JA. (2008). Inherited pancreatic endocrine tumor syndromes: advances in molecular pathogenesis, diagnosis, management and controversies. *Cancer*, 113, 1807–1843. doi: 10.1002/cncr.23648.
- Kalra MK, Maher MM, Mueller PR, Saini S. (2003). State-of-the-art imaging of pancreatic neoplasms. *British Journal of Radiology*, 76, 857–65. doi:10.1259/bjr/16642775
- King J, Kazanjian K, Matsumoto J, Reber HA, Yeh MW, Hines OJ... (2008). Distal pancreatectomy: incidence of postoperative diabetes. *Journal of Gastrointestinal Surgery*, 12, 1548–1553. doi: 10.1007/s11605-008-0560-5
- Lairmore TC, Govindnick CM, Quinn CE, Sigmund BR, Lee CY, Jupiter DC. (2014). A randomized, prospective trial of operative treatments for hyperparathyroidism in patients with multiple endocrine neoplasia type 1. *Surgery*, 156, 1326–1334. doi: 10.1016/j.surg.2014.08.006
- Lairmore TC, Moley JF. (2017) The Multiple Endocrine Neoplasia

- Syndromes Sabiston Textbook of Surgery, Eds. Townsend CM, et al. Elsevier, 20th Edition, Philadelphia, , pp: 996–1012
- Langer P, Kann PH, Fendrich V, Richter G, Diehl S, Rothmund M, Bartsch DK. (2004). Prospective evaluation of imaging procedures for the detection of pancreaticoduodenal endocrine tumors in patients with multiple endocrine neoplasia type 1. *World Journal of Surgery*, 28, 1317–1322. doi: 10.1007/s00268-004-7642-7
- Lee MPN. (2013). Multiple endocrine neoplasia type 4. *Frontiers of Hormone Research*, 41, 63–78. doi: 10.1159/000345670.
- Lemos MC, Thakker RV. (2008). Multiple endocrine neoplasia type 1 (MEN1): analysis of 1336 mutations reported in the first decade following identification of the gene. *Human Mutation*, 29(1), 22–32. doi:10.1002/humu.20605
- Levy-Bohbot N, Merle C, Goudet P, Delemer B, Calender A, Jolly D... (2004). Groupe des Tumeurs Endocrines. Prevalence, characteristics and prognosis of MEN 1-associated glucagonomas, VIPomas, and somatostatinomas: study from the GTE (Groupe des Tumeurs Endocrines) registry. *Gastroenterol Clin Biol.*, 28, 1075–1081. https://www.sciencedirect.com/journal/gastroenterologie-clinique-et-biologique.
- Lopez CL, Falconi M, Waldmann J, Boninsegna L, Fendrich V, Goretzki PK... (2013). Partial pancreaticoduodenectomy can provide cure for duodenal gastrinoma associated with multiple endocrine neoplasia type 1. *Ann Surg.* 257(2):308–314. doi: 10.1097/SLA.0b013e3182536339
- Marx SJ, Vinik AI, Santen RJ, Floyd JC Jr, Mills JL, Green J 3rd. (1986). Multiple endocrine neoplasia type I: assessment of laboratory tests to screen for the gene in a large kindred. *Medicine (Baltimore)*, 65(4), 226–241. https://journals.lww.com/md-journal/Subjects. [PubMed: 2873498]
- Marx SJ, Agarwal SK, Kester MB, Heppner C, Kim YS, Emmert-Buck MR ... (1998). Germline and somatic mutation of the gene for multiple endocrine neoplasia type 1 (MEN1). *Journal of Internal Medicine*, 243, 447–453. doi:10.1046/j.1365-2796.1998.00348.x
- Marx SJ. (2013). Multiplicity of hormone-secreting tumors: common themes about cause, expression, and management. *Journal of Clinical Endocrinology and Metabolism*, 98, 3139–3148. doi: 10.1210/jc.2013-1511
- Matkar STA, Thiel A, Hua X. (2013). Menin: a scaffold protein that controls gene expression and cell signaling. *Trends Biochemical Science*, 38(8), 394–402. doi:10.1016/j.tibs.2013.05.005
- Moline J, Eng C. (2011). Multiple endocrine neoplasia type 2: An overview. *Genetics in Medicine*, 13, 755–764. doi: 10.1097/GIM.0b013e318216cc6d.
- Mulligan LM, Kwok JB, Healey CS, et al: Germ-line mutations of the RET proto-oncogene in multiple endocrine neoplasia type 2A. *Nature* 363:458–460, 1993.
- Nilubol N, Weisbrod AB, Weinstein LS, Simonds WF, Jensen RT, Phan GQ, Hughes MS... (2013). Utility of intraoperative parathyroid hormone monitoring in patients with multiple endocrine neoplasia type 1-associated primary hyperparathyroidism undergoing initial parathyroidectomy. *World Journal of Surgery*, 37, 1966–1972. doi: 10.1007/s00268-013-2054-1
- Norton JA, Alexander HL, Fraker DL, Venzon DJ, Gibril F, Jensen RT. Comparison of surgical results in patients with advanced and limited disease with multiple endocrine neoplasia type 1 and Zollinger-Ellison syndrome. *Annals of surgery*, 234(4):495–506. [PubMed: 11573043] https://journals.lww.com/annalsofsurgery/pages/default.aspx
- Norton JA, Froome LC, Farrell RE, Wells SA Jr. (1979). Multiple endocrine neoplasia type IIb: the most aggressive form of medullary thyroid carcinoma. *Surgical Clinics of North America*, 59(1), 109–118. https://www.journals.elsevier.com/surgical-clinics-of-north-america
- Norton JA, Jensen R. (2004). Resolved and unresolved controversies in the surgical management of patients with Zollinger-Ellison syndrome. *Annals of surgery*, 240, 757–773. https://journals.lww.com/annalsofsurgery/pages/default.aspx
- Norton JA, Krampitz G, Jensen RT. (2015). Multiple Endocrine Neoplasia: Genetics & Clinical Management. *Surgical Oncology Clinics of North America*, 24, 795–832. doi:10.1016/j.soc.2015.06.008.
- Norton JA, Venzon DJ, Berna MJ, Alexander HR, Fraker DL, Libutti SK, Marx SJ... (2008). Prospective study of surgery for primary hyperparathyroidism (HPT) in multiple endocrine neoplasia-type 1 and Zollinger-Ellison syndrome: long-term outcome of a more virulent form of

- HPT. *Annals of Surgery*, 247, 501–510. doi: 10.1097/SLA.0b013e31815efda5
- Nunes VS, Souza GL, Perone D, Conde SJ, Nogueira CR. (2014). Frequency of multiple endocrine neoplasia type 1 in a group of patients with pituitary adenoma: genetic study and familial screening. *Pituitary*, 17, 30–37. doi: 10.1007/s11102-013-0462-8.
- Pardi EMS, Mariotti S, Pellegata NS, Benfini K, Borsari S, Saponaro F.... (2015). Functional characterization of a CDKN1B mutation in a Sardinian kindred with multiple endocrine neoplasia type 4 (MEN4). *Endocr Connect*, Mar; 4(1):1-8. doi:10.1530/EC-14-0116
- Pellegata NSQ-ML, Siggelkow H, Samson E, Bink K, Höfler H, Fend F... (2006). Germ-line mutations in p27Kip1 cause a multiple endocrine neoplasia syndrome in rats and humans. *Proc Natl Acad Sci USA*; 103:15558–15563. doi: 10.1073/pnas.0603877103
- Poultsides GA, Huang LC, Chen Y, Visser BC, Pai RK, Jeffrey RB... (2012). Pancreatic neuroendocrine tumors: radiographic calcifications correlate with grade and metastasis. *Annals of Surgical Oncology*, 19, 2295–2303. doi: 10.1245/s10434-012-2305-7
- Romei C, Pardi E, Cetani F, Elisei R. (2012). Genetic and clinical features of multiple endocrine neoplasia types 1 and 2. *Journal of Oncology*, 705036, 1-14. doi: 10.1155/2012/705036
- Sachithanandan N, Harle RA, Burgess JR. 2005Bronchopulmonary carcinoid in multiple endocrine neoplasia type 1. *Cancer*, 103, 509–515. doi:10.1002/cncr.20825
- Scarsbrook AF, Thakker RV, Wass JA, Gleeson FV, Phillips RR. (2006). Multiple endocrine neoplasia: spectrum of radiologic appearances and discussion of a multitechnique imaging approach. *Radiographics*, 26, 433–51. doi:10.1148/rug.262055073
- Scherubl H, Cadiot G, Jensen RT, Rosch T, Stolzel U, Kloppel G. (2010). Neuroendocrine tumors of the stomach (gastric carcinoids) are on the rise: small tumors, small problems? *Endoscopy*, 42, 664–671. doi: 10.1055/s-0030-1255564
- Scholten AVG, Valk GD, Ulfman D, Borel Rinkes IH, Vriens MR. (2011). Unilateral adrenalectomy for pheochromocytoma in Multiple Endocrine Neoplasia Type 2 patients. *Annals of Surgery*, 254, 1022–1027. doi: 10.1097/SLA.0b013e318237480c
- Skogseid B, Oberg K. (1995). Experience with multiple endocrine neoplasia type 1 screening. *Journal of International Medicine*, 238(3), 255–261. <https://doi.org/10.1111/j.1365-2796.1995.tb00932.x>
- Singh Ospina N, Sebo TJ, Thompson GB, Clarke BL, Young WF Jr. (2016). Prevalence of parathyroid carcinoma in 348 patients with multiple endocrine neoplasia type 1 - case report and review of the literature. *Clinical Endocrinology*, 84, 244–249. doi:10.1111/cen.12714
- Singh Ospina N, Thompson GB, Lee RA, Reading CC, Young WF Jr. (2015). Safety and efficacy of percutaneous parathyroid ethanol ablation in patients with recurrent primary hyperparathyroidism and multiple endocrine neoplasia type 1. *Journal of Clinical Endocrinology and Metabolism*, 100, e87–90
- Thakker RV. (2010). Multiple endocrine neoplasia type 1 (MEN1). *Best Practice and Research Clinical Endocrinology and Metabolism*, 24, 355–370. doi: 10.1016/j.beem.2010.07.003
- Thakker R.V. (1998). Multiple endocrine neoplasia-syndromes of the twentieth century. *Journal of Clinical Endocrinology and Metabolism*, 83, 2617–2620. doi: 10.1210/jcem.83.8.5045
- Thakker RV. (2014). Multiple endocrine neoplasia type! (MEN1) and type 4 (MEN4). *Molecular Cell Endocrinology*, 386(1-2), 2–15. doi: 10.1016/j.mce.2013.08.002
- Thakker RV, Newey PJ, Walls GV, Bilezikian J, Dralle H, Ebeling PR... (2012). Clinical practice guidelines for multiple endocrine neoplasia type 1 (MEN1). *Journal of Clinical Endocrinology and Metabolism*, 97, 2990–3011. doi: 10.1210/jc.2012-1230
- Tham E, Grandell U, Lindgren E, Toss G, Skogseid B, Nordenskjöld M. (2007). Clinical testing for mutations in the MEN1 gene in Sweden: a report on 200 unrelated cases. *Journal of Clinical Endocrinology and Metabolism*, 92, 3389–3395. doi:10.1210/jc.2007-0476
- Thoeni RF, Mueller-Lisse UG, Chan R, Do NK, Shyn PB. (2000). Detection of small, functional islet cell tumors in the pancreas: selection of MR imaging sequences for optimal sensitivity. *Radiology*, 214, 483–90. 10.1148/radiology.214.2.r00fe32483
- Triponez F, Dosseh D, Goudet P, Cougard P, Bauters C, Murat A... (2006). Epidemiology Data on 108 MEN 1 Patients From the GTE With Isolated Nonfunctioning Tumors of the Pancreas. *Annals of Surgery*,

- 243, 265–272. doi:10.1097/01.sla.0000197715.96762.68
- Turner, J.J., Christie, P.T., Pearce, S.H., Turnpenny, P.D., Thakker, R.V., (2010). Diagnostic challenges due to phenocopies: lessons from Multiple Endocrine Neoplasia type1 (MEN1). *Hum. Mutat.*, 31, e1089–1101. doi: 10.1002/humu.21170.
- Vierimaa O, Ebeling TM, Kytola S, Bloigu R, Eloranta E, Salmi J, Korpi-Hyovalti E... (2007). Multiple endocrine neoplasia type 1 in Northern Finland; clinical features and genotype phenotype correlation. *European Journal of Endocrinology*, 157, 285–294. doi:10.1530/EJE-07-0195
- Vernick M, Popadich A, Sidhu S, Sywak M, Robinson B, Delbridge L. (2013). Minimally invasive parathyroidectomy provides a conservative surgical option for multiple endocrine neoplasia type 1-primary hyperparathyroidism. *Surgery*, 154, 101–105. doi: 10.1016/j.surg.2013.03.004.
- Vezzosi D, Cardot-Bauters C, Bouscaren N, Lebras M, Bertholon-Grégoire M, Niccoli P, Levy-Bohbot N... (2015). Long-term results of the surgical management of insulinoma patients with MEN1: a Groupe d'étude des Tumeurs Endocrines (GTE) retrospective study. *European Journal of Endocrinology*, 172, 309–319. doi: 10.1530/EJE-14-0878
- Waldmann J, Fendrich V, Habbe N, Bartsch DK, Slater EP, Kann PH, Rothmund M... (2009). Screening of patients with multiple endocrine neoplasia type 1 (MEN-1): a critical analysis of its value. *World Journal of Surgery*, 33, 1208–1218. doi: 10.1007/s00268-009-9983-8
- Walls GV. (2014). Multiple endocrine neoplasia (MEN) syndromes. *Seminars in Pediatric Surgery*, 23(2), 96–101. doi: 10.1053/j.sempedsurg.2014.03.008
- Wilkinson S, Teh BT, Davey KR, McArdle JP, Young M, Shepherd JJ. (1993). Cause of death in multiple endocrine neoplasia type 1. *Archives of Surgery*, 128(6), 683–690. doi:10.1001/archsurg.1993.01420180085016
- Wells SA Jr, Asa SL, Dralle H, Elisei R, Evans DB, Gagel RF. *Thyroid*, 2015, 25(6), 567–610. doi:10.1089/thy.2014.0335
- Worhunsky DJ, Krampitz GW, Poullos PD, Visser BC, Kunz PL, Fisher GA... (2014). Pancreatic neuroendocrine tumours: hypoenhancement on arterial phase computed tomography predicts biological aggressiveness. *HPB (Oxford)*, 16, 304–11. doi: 10.1111/hpb.12139.