



Autoanticorpi nelle malattie della giunzione neuromuscolare




Miastenia gravis

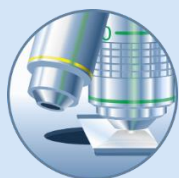
home

Sindrome di Lambert e Eaton

Neuromiotonia

Sindrome di Morvan

- autoanticorpi come marcatori diagnostici della malattia con un diretto ruolo patogenetico
 - autoanticorpi come marcatori diagnostici della malattia principale indicata
 - cerchi colorati caratterizzano i marcatori per investigazioni primarie
 - autoanticorpi come mezzi ausiliari per la diagnosi della malattia
 - autoanticorpi riscontrabili in prima linea in associazione ad altre malattie
 - autoanticorpi senza valore diagnostico per la malattia indicata
- La **letteratura** citata è segnata con numeri **rossi**: cliccandoli si va agli autori alla fine del documento. Cliccando il simbolo della mano () si ritornerà all'inizio della tabella rispettiva.
- I nomi degli **autoanticorpi** oppure le loro abbreviazioni elencati nelle tabelle sono collegate con le descrizioni, che si aprono cliccando i nomi rispettivi.
- Le **sensibilità** e **specificità** indicate dipendono decisamente sia dai metodi di dosaggio, sia dalle variabilità genetiche ed etno-geografiche sia dai gruppi di pazienti e dai controlli esaminati, tutto ciò si riflette in risultanze considerabilmente divergenti. Di conseguenza i numeri indicati trasmettono solo un riferimento approssimativo per la selezione di un'indagine adatta alle questioni cliniche. Per questo tante volte sono state indicate valutazioni qualitative quali "bassa", "media" oppure "alta".



Autoanticorpi nelle malattie della giunzione neuromuscolare



Miastenia gravis

Autoanticorpi	Sens [%]	Spec [%]	Malattie associate
● Recettore dell'acetilcolina muscolare	50 - 90	alta	
● MuSK *	< 10	alta	15
● Lrp4	< 10	alta	
● Agrina	< 10	alta	26, 27
● Canale del potassio Kv1.4	12 - 15	alta	
● Collagene Q	3	alta	28
● Recettore di rianodina (RyR)	15 - 20	alta	timoma
● Titina	30	alta	timoma
● Recettore della diidropiridina (Ca _v 1.1)	37	alta	timoma
● Canali TRPC3	36	alta	timoma
● Gravina (AKAP-12)	31	alta	4
● Rapsina	bassa	intermedia	1
● Muscolo scheletrico (FI)	80	intermedia	
● Acquaporina 4	bassa	bassa	NMO 3, 7, 8, 13, 19
● CASPR2	bassa	bassa	NM, MS 19, 20
● Actina	< 5	bassa	EA 14, 17, 21, 22
● α-Actinina	< 25	bassa	EA 14, 17, 21, 22
● Filamina	< 10	bassa	9, 23
● Proteina heat shock 70 (Hsp70)	< 20	bassa	6, 12
● Proteina heat shock HSC71	< 20	bassa	12
● Interferone-α2	< 20	bassa	2, 5, 10, 11, 16
● Interferone-α8	< 20	bassa	2, 5, 10, 11, 16
● Interferone-ω	< 20	bassa	2, 5, 10, 11
● Interleuchina-12	< 20	bassa	5, 10, 11, 16, 18, 24, 25
● Miosina	< 50	bassa	14, 17, 21, 22
● Tropomiosina	< 30	bassa	17, 23
● Troponina	< 30	bassa	17
● Vinculina	< 10	bassa	23

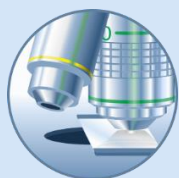
AH: epatite autoimmune MS: sindrome di Morvan NM: neuromiotonia

NMO: neuromielite ottica

* un antigene corrispondente a MuSK è stato descritto e denominato proteina p110 ¹⁵

🔍 Indice delle malattie

🔍 Abbreviazioni



Autoanticorpi nelle malattie della giunzione neuromuscolare



Sindrome di Lambert e Eaton

Autoanticorpi	Sens [%]	Spec [%]	Malattie associate
● Canale di calcio (VGCC)	90 - 100	alta	SCLC (60%), EL, DC, NS, DA
● Canale di calcio Ca _v 2.1 (tipo P/Q)	90 - 100 ^{*1}	alta	NS, DA 8, 10
● Canale di calcio Ca _v 2.2 (tipo N)	33 - 49 ^{*1}	alta	DA 7, 8, 10
● Canale di calcio Ca _v 1.1 (tipo L)	casistiche	non nota	1, 5
● Canale di calcio subunità β	23 - 55	non nota	14, 15, 24
● SOX1 ^{*2}	bis 67	alta (SCLC)	marcatore della SCLC ²¹ 16, 20
● Sinaptotagmina 1	30 ^{*3}	non nota	2, 17
● Recettore dell'acetilcolina muscolare	casistiche		MG/LEMS overlap 6, 11, 12
● Recettore M1 mAChR	70 ^{*4}	non nota	18, 19
● Glutammato decarbossilasi (GAD)	35	non nota	4
● IA-2 (tirosina fosfatasi)	21	non nota	4
● Hu	casistiche ^{*5}		3, 9, 13, 22
● CV2/CRMP5	5	non nota	16
● PCA-2	casistiche		23

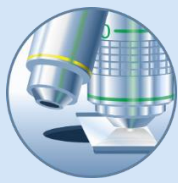
DC: degenerazione cerebellare DA: disautonomia EL: encefalite limbica
 LEMS: sindrome di Lambert e Eaton MG: miastenia gravis SCLC: microcitoma polmonare
 NS: neuropatia sensoria

- ^{*1} meno frequente in forme paraneoplastiche con SCLC
- ^{*2} reattività incrociata con SOX2, SOX3, SOX21
- ^{*3} non è stata trovata in tutti i campioni esaminati ²
- ^{*4} presenza anche in pazienti con LEMS anti-VGCC negativi 18, 19
- ^{*5} 9 % vedi Mason et al. (1997) ⁹

vedi anche: Autoanticorpi nelle sindromi neurologiche paraneoplastiche

[Indice delle malattie](#)

[Abbreviazioni](#)



Autoanticorpi nelle malattie della giunzione neuromuscolare

Neuromiotonia

Autoanticorpi	Sens [%]	Spec [%]	Malattie associate
● Canale di potassio (complesso) * ¹	54 ¹³ - 95	alta * ²	timoma , SCLC, DA 3, 4, 5
● Canale di potassio Kv1.1 * ³	< 3		4, 7, 8
● Canale di potassio Kv1.2 * ³	< 3		4, 7, 8
● Canale di potassio Kv1.6 * ³	< 3		4, 7, 8
● CASPR2	alta	alta * ²	7, 9, 14
● LGI1	bassa	alta * ²	2, 7
● Tag-1/Contactin 2	bassa	alta * ²	7
● Recettore dell'acetilcolina muscolare	14 ¹³		timoma 6, 13
● Recettore dell'acetilcolina ganglionare	14 ¹³		tumori associati * ⁴ 12, 13
● MuSK	casistiche		11a
● Recettore di rianodina (RyR)	casistiche		timoma 10
● Amfifisina	casistiche		paraneoplasia 11
● Glutammato decarbossilasi (GAD)	casistiche		timoma 1

DA: disautonomia SCLC: microcitoma polmonare

*¹ I bersagli degli anticorpi per lo più non sono le proteine formanti il poro del canale (Kv1.1, 1.2, 1.6) ma le proteine associate CASPR2, LGI1, Tag-1 (complesso canale).

*² Valida per neuromiotonia, sindrome di Morvan e encefalite limbica.

*³ Autoanticorpi dimostrati mediante IFI con cellule trasfettate esprimenti la proteina canale rispettiva (4, 8); i risultati non potevano essere confermati con regolarità (7).

*⁴ Timoma (anti-CRMP5 positiva), microcitoma polmonare (SCLC; anti-CRMP5 positiva), carcinoma polmonare (anti-amfifisina positivo), SCLC (ANNA positiva) (13).

[Indice delle malattie](#)

[Abbreviazioni](#)



Autoanticorpi nelle malattie della giunzione neuromuscolare



Sindrome di Morvan

Autoanticorpi	Sens [%]	Spec [%]	Malattie associate
● Canale di potassio (complesso) ^{*1}	40 - 80	alta ^{*3}	LE, NM, EP, timoma 1, 6, 7
● Canale di potassio Kv1.1 ^{*2}	< 3		4
● Canale di potassio Kv1.2 ^{*2}	< 3		4
● Canale di potassio Kv1.6 ^{*2}	< 3		4
● CASPR2	alta	alta ^{*3}	LE, NM, EP 9
● LGI1	bassa	alta ^{*3}	LE, NM, EP 5
● Tag-1/Contactin 2	bassa	alta ^{*3}	8
● Recettore dell'acetilcolina muscolare	casistica		timoma, MG/SM 2, 3, 6
● Titina	casistica		timoma 6
● Muscolo scheletrico (IFI)	casistica		timoma 6
● Canale di calcio Ca _v 2.2 (tipo N)	casistica		6

LE: encefalite limbica NM: neuromiotonia EP: epilessia, convulsioni

MG/MS: sindrome di overlap con miastenia gravis e anticorpi anti-AChR, anti-MuSK e anti-VGKC

^{*1} I bersagli degli anticorpi per lo più non sono le proteine formanti il poro del canale (Kv1.1, 1.2, 1.6) ma le proteine associate CASPR2, LGI1, Tag-1 (complesso canale).

^{*2} Autoanticorpi dimostrati mediante IFI con cellule trasfettate esprimenti la proteina canale rispettiva; i risultati non potevano essere confermati con regolarità (vedi letteratura: tabella neuromiotonia 7).

^{*3} Valida per neuromiotonia, sindrome di Morvan e encefalite limbica.

vedi anche: Autoanticorpi nelle sindromi neurologiche paraneoplastiche

[Indice delle malattie](#)

[Abbreviazioni](#)




Autoanticorpi nelle malattie della giunzione neuromuscolare



Abbreviazioni

Sens	sensibilità
Spec	specificità
CASPR2	contactin-assoziatoed protein-2
CV2/CRMP5	collapsing response mediator protein 5
Hu	Iniziali del nome del paziente
IA2	islet cell antigen 2
IIFT	immunofluorescenza indiretta
GAD	glutamate decarboxylase
LGI1	leucine-rich glioma inactivated 1
Lrp4	low density lipoprotein receptor-related protein 4
M1 mAChR	recettore muscarinico colinergico M1
MuSK	tirosinchinasi muscolo specifico
PCA-2	purkinje cell antibody Typ 2
SOX1	sex determining region y-box 1
Tag-1/Contactin 2	transient axonal glycoprotein 1
TRPC3	transient receptor potential canonical type 3
VGCC	voltage gated calcium channel (canali del calcio voltaggio dipendenti)
VGKC	voltage gated potassium channel (canali del potassio voltaggio dipendenti)

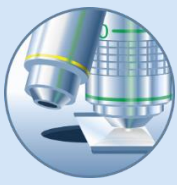
 [Indice delle malattie](#)



Autoanticorpi nelle malattie della giunzione neuromuscolare

Miastenia gravis

- 1 Agius MA, Zhu S, Kirvan CA, Schafer AL, Lin MY, Fairclough RH, Oger JJ, Aziz T, Aarli JA: Rapsyn antibodies in myasthenia gravis. *Ann N Y Acad Sci* (1998); 841: 516 - 521 (PMID: [9668284](#)).
- 2 Bagnato F, Clemenzi A, Scagnolari C, Strizzi L, Di Pasquale A, Bellomi F, Di Marco P, Antonelli G, Antonini G: Neutralizing antibodies against endogenous interferon in myasthenia gravis patients. *Eur Cytokine Netw* (2004); 15(1): 24 - 29 (PMID: [15217749](#)).
- 3 Ekizoğlu E, Yılmaz V, İçöz S, Birişik Ö, Tüzün E, Akman-Demir G, Saruhan-Direskeneli G, Deymeer F: Aquaporin-4 antibody seropositivity in myasthenia gravis patients with thymoma. *Muscle Nerve* (2013); 47(2): 306 - 307 (PMID: [23349085](#)).
- 4 Gordon T, Grove B, Loftus JC, O'Toole T, McMillan R, Lindstrom J, Ginsberg MH: Molecular cloning and preliminary characterization of a novel cytoplasmic antigen recognized by myasthenia gravis sera. *J Clin Invest* (1992); 90(3): 992 - 999 (PMID: [1522245](#)).
- 5 Hapnes L, Willcox N, Oftedal BE, Owe JF, Gilhus NE, Meager A, Husebye ES, Wolff AS: Radioligand-binding assay reveals distinct autoantibody preferences for type I interferons in APS I and myasthenia gravis subgroups. *J Clin Immunol* (2012); 32(2): 230 - 237 (PMID: [22127461](#)).
- 6 Helgeland G, Petzold A, Hoff JM, Gilhus NE, Plant GT, Romi FR: Anti-Heat Shock Protein 70 antibody levels are increased in myasthenia gravis and Guillain-Barré syndrome. *J Neuroimmunol* (2010); 225(1 - 2): 180 - 183 (PMID: [20554026](#)).
- 7 Jarius S, Paul F, Franciotta D, de Seze J, Münch C, Salvetti M, Ruprecht K, Liebetrau M, Wandinger KP, Akman-Demir G, Melms A, Kristoferitsch W, Wildemann B: Neuromyelitis optica spectrum disorders in patients with myasthenia gravis: ten new aquaporin-4 antibody positive cases and a review of the literature. *Mult Scler* (2012); 18(8): 1.135 - 1.143 (PMID: [22183934](#)).
- 8 Leite MI, Coutinho E, Lana-Peixoto M, Apostolos S, Waters P, Sato D, Melamed L, Marta M, Graham A, Spillane J, Villa AM, Callegaro D, Santos E, da Silva AM, Jarius S, Howard R, Nakashima I, Giovannoni G, Buckley C, Hilton-Jones D, Vincent A, Palace J: Myasthenia gravis and neuromyelitis optica spectrum disorder: a multicenter study of 16 patients. *Neurology* (2012); 78(20): 1.601 - 1.607 (PMID: [22551731](#)).
- 9 Lin H. [ELISA for detection of anti-filamin antibody in sera from patient with myasthenia gravis]. *Zhonghua Shen Jing Jing Shen Ke Za Zhi*. 1992; 25(5):281 - 283, 316 - 317. Chinese (PMID: [1291249](#)).
- 10 Meager A, Vincent A, Newsom-Davis J, Willcox N: Spontaneous neutralizing antibodies to interferon - alpha and interleukin-12 in thymoma-associated autoimmune disease. *Lancet* (1997); 350(9091): 1.596 - 1.597 (PMID: [9393342](#)).
- 11 Meager A, Wadhwa M, Dilger P, Bird C, Thorpe R, Newsom-Davis J, Willcox N: Anti-cytokine autoantibodies in autoimmunity: preponderance of neutralizing autoantibodies against interferon-alpha, interferon-omega and interleukin-12 in patients with thymoma and/or myasthenia gravis. *Clin Exp Immunol* 132(1): 128 - 136 (PMID: [12653847](#)).
- 12 Munakata S, Chen M, Aosai F, Kawaguchi N, Nemoto Y, Norose K, Hattori T, Yano A: The clinical significance of anti-heat shock cognate protein 71 antibody in myasthenia gravis. *J Clin Neurosci* (2008); 15(2): 158 - 165 (PMID: [17981040](#)).
- 13 Ogaki K, Hirayama T, Chijiwa K, Fukae J, Furuya T, Noda K, Fujishima K, Hattori N, Takahashi T, Okuma Y: Anti-aquaporin-4 antibody-positive definite neuromyelitis optica in a patient with thymectomy for myasthenia gravis. *Neurologist* (2012); 18(2): 76 - 79 (PMID: [22367834](#)).
- 14 Ohta M, Ohta K, Itoh N, Kurobe M, Hayashi K, Nishitani H: Anti-skeletal muscle antibodies in the sera from myasthenic patients with thymoma: identification of anti-myosin, actomyosin, actin, and alpha-actinin antibodies by a solid-phase radioimmunoassay and a western blotting analysis. *Clin Chim Acta* (1990); 187(3): 255 - 264 (PMID: [2323065](#)).
- 15 Scuderi F, Marino M, Colonna L, Mannella F, Evoli A, Provenzano C, Bartoccioni E: Anti-p110 autoantibodies identify a subtype of "seronegative" myasthenia gravis with prominent oculobulbar involvement. *Lab Invest* (2002); 82(9): 1.139 - 1.146 (PMID: [12218](#)).



Autoanticorpi nelle malattie della giunzione neuromuscolare

- 16 Shiono H, Wong YL, Matthews I, Liu JL, Zhang W, Sims G, Meager A, Beeson D, Vincent A, Willcox N: Spontaneous production of anti-IFN-alpha and anti-IL-12 autoantibodies by thymoma cells from myasthenia gravis patients suggests autoimmunization in the tumor. *Int Immunol* (2003); 15(8): 903 - 913 (PMID: [12882828](#)).
 - 17 Takaya M, Kawahara S, Namba T, Grob D: Antibodies against myofibrillar proteins in myasthenia gravis patients. *Tokai J Exp Clin Med* (1992); 17(1): 35 - 39 (PMID: [1523691](#)).
 - 18 Tackenberg B, Schlegel K, Happel M, Eienbröcker C, Gellert K, Oertel WH, Meager A, Willcox N, Sommer N: Expanded TCR Vbeta subsets of CD8(+) T-cells in late-onset myasthenia gravis: novel parallels with thymoma patients. *J Neuroimmunol* (2009); 216(1-2): 85 - 91 (PMID: [19781791](#)).
 - 19 Vincent A, Waters P, Leite MI, Jacobson L, Konecny I, Cossins J, Beeson D: Antiodies identified by cell-based assays in myasthenia gravis and associated diseases. *Ann N Y Acad Sci* (2012); 1.274: 92 - 8 (PMID: [23252902](#)).
 - 20 Vincent A, Irani SR: Caspr2 antibodies in patients with thymomas. *J Thorac Oncol* (2010); 5(10 Suppl 4): S277 - 280 (PMID: [20859119](#)).
 - 21 Williams CL, Lennon VA, Momoi MY, Howard FM Jr: Serum antibodies and monoclonal antibodies secreted by thymic B-cell clones from patients with myasthenia gravis define striational antigens. *Ann N Y Acad Sci* (1987); 505: 168 - 179 (PMID: [3500666](#)).
 - 22 Williams CL, Lennon VA: Thymic B lymphocyte clones from patients with myasthenia gravis secrete monoclonal striational autoantibodies reacting with myosin, alpha actinin, or actin. *J Exp Med* (1986); 164(4): 1.043 - 1.059 (PMID: [3020150](#)).
 - 23 Yamamoto T, Sato T, Sugita H: Antifilamin, antivinculin, and antitropomyosin antibodies in myasthenia gravis. *Neurology* (1987); 37(8): 1.329 - 1.333 (PMID: [3112609](#)).
 - 24 Yoshikawa H, Sato K, Edahiro S, Furukawa Y, Maruta T, Iwasa K, Watanabe H, Takaoka S, Suzuki Y, Takamori M, Yamada M: Elevation of IL-12 p40 and its antibody in myasthenia gravis with thymoma. *J Neuroimmunol* (2006); 175(1-2): 169 - 175 (PMID: [16574246](#)).
 - 25 Zhang W, Liu JL, Meager A, Newsom-Davis J, Willcox N: Autoantibodies to IL-12 in myasthenia gravis patients with thymoma; effects on the IFN-gamma responses of healthy CD4+ T cells. *J Neuroimmunol* (2003); 139(1-2): 102 - 108 (PMID: [12799027](#)).
- Addenda
- 26 Gasperi C, Melms A, Schooser B, Zhang Y, Meltoranta J, Risson V, Schaeffer L, Schalke B, Kröger S: Anti-agrin autoantibodies in myasthenia gravis. *Neurology* (2014); 82(22): 1.976 - 1.983 (PMID: [24793185](#)).
 - 27 Zhang B, Shen C, Bealmear B, Ragheb S, Xiong WC, Lewis RA, Lisak RP, Mei L: Autoantibodies to agrin in myasthenia gravis patients. *PLoS One* (2014); 9(3): e91816 (PMID: [24632822](#)).
 - 28 Zoltowska Katarzyna M, Belaya K, Leite M, Patrick W, Vincent A, Beeson D: Collagen Q - A potential target for autoantibodies in myasthenia gravis. *J Neurol Sci* (2015); 348(1-2): 241 - 244 (PMID: [25577314](#)).

LEMS

- 1 el Far O, Marquèze B, Leveque C, Martin-Moutôt N, Lang B, Newsom-Davis J, Yoshida A, Takahashi M, Seagar MJ: Antigens associated with N- and L-type calcium channels in Lambert-Eaton myasthenic syndrome. *J Neurochem* (1995); 64(4): 1.696 - 1.702 (PMID: [7891097](#)).
- 2 Hajela RK, Atchison WD: The proteins synaptotagmin and syntaxin are not general targets of Lambert-Eaton myasthenic syndrome autoantibody. *J Neurochem* (1995); 64(3): 1.245 - 1.521 (PMID: [7861157](#)).
- 3 Heidenreich F, Schober R, Brinck U, Hartung HP: Multiple paraneoplastic syndromes in a patient with antibodies to neuronal nucleoproteins (anti-Hu). *J Neurol* (1995); 242(4): 210 - 216 (PMID: [77981199](#)).
- 4 Hermitte L, Martin-Moutot N, Boucraut J, Barone R, Atlan-Gepner C, Seagar M, Pouget J, Kleisbauer JP, Couraud F, Vialettes B: Humoral immunity against glutamic acid decarboxylase and tyrosine phos-



Autoanticorpi nelle malattie della giunzione neuromuscolare

- phatase IA-2 in Lambert-Eaton myasthenic syndrome. *J Clin Immunol* (2000); 20(4): 287 - 293 (PMID: [10939716](#)).
- 5 Hiroi Y, Nakao T, Tsuchiya N, Takeda N, Maemura K, Nakamura F, Ohno M, Hirata Y, Nagai R: Exacerbation of Lambert-Eaton myasthenic syndrome caused by an L-type Ca²⁺ channel antagonist. *Jpn Heart J* (2003); 44(1): 139 - 144 (PMID: [12622445](#)).
 - 6 Katz JS, Wolfe GI, Bryan WW, Tintner R, Barohn RJ: Acetylcholine receptor antibodies in the Lambert-Eaton myasthenic syndrome. *Neurology* (1998); 50(2): 470 - 475 (PMID: [9484374](#)).
 - 7 Kimpinski K, Iodice V, Vernino S, Sandroni P, Low PA: Association of N-type calcium channel autoimmunity in patients with autoimmune autonomic ganglionopathy. *Auton Neurosci* (2009); 150(1 - 2): 136 - 139 (PMID: [19541551](#)).
 - 8 Lennon VA, Kryzer TJ, Griesmann GE, O'Suilleabhain PE, Windebank AJ, Woppmann A, Miljanich GP, Lambert EH: Calcium-channel antibodies in the Lambert-Eaton syndrome and other paraneoplastic syndromes. *N Engl J Med* (1995); 332(22): 1.467 - 1.474 (PMID: [7739683](#)).
 - 9 Mason WP, Graus F, Lang B, Honnorat J, Delattre JY, Valldeoriola F, Antoine JC, Rosenblum MK, Rosenfeld MR, Newsom-Davis J, Posner JB, Dalmau J: Small-cell lung cancer, paraneoplastic cerebellar degeneration and the Lambert-Eaton myasthenic syndrome. *Brain* (1997); (PMID: [9278623](#)).
 - 10 Motomura M, Lang B, Johnston I, Palace J, Vincent A, Newsom-Davis J: Incidence of serum anti-P/O-type and anti-N-type calcium channel autoantibodies in the Lambert-Eaton myasthenic syndrome. *J Neurol Sci* (1997); 147(1): 35 - 42 (PMID: [9094058](#)).
 - 11 Oh SJ, Dwyer DS, Bradley RJ: Overlap myasthenic syndrome: combined myasthenia gravis and Eaton-Lambert syndrome. *Neurology* (1987); 37(8): 1.411 - 1.414 (PMID: [3614671](#)).
 - 12 Oh SJ, Sher E: MG and LEMS overlap syndrome: case report with electrophysiological and immunological evidence. *Clin Neurophysiol* (2005); 116(5): 1.167 - 1.171 (PMID: [15826858](#)).
 - 13 Pieret F, Sindic CJ, Chalon MP, Warny M, Bolyn S, Dehaene I, Gobiet Y, Goka S, Laloux P, Monteyne P, Peeters A, Pierre P, Gillet S, Van den Bergh PY, Windhausen K, Laterre C: The anti-Hu syndrome: a clinical and immunological study of 7 cases. *Acta Neurol Belg* (1996); 96(2): 108 - 116 (PMID: [8711983](#)).
 - 14 Raymond C, Walker D, Bichet D, Iborra C, Martin-Moutot N, Seagar M, De Waard M: Antibodies against the beta subunit of voltage-dependent calcium channels in Lambert-Eaton myasthenic syndrome. *Neuroscience* (1999); 90(1): 269 - 277 (PMID: [10188953](#)).
 - 15 Rosenfeld MR, Wong E, Dalmau J, Manley G, Egan D, Posner JB, Sher E, Furneaux HM: Sera from patients with Lambert-Eaton myasthenic syndrome recognize the beta-subunit of Ca²⁺ channel complexes. *Ann N Y Acad Sci* (1993); 681: 408 - 411 (PMID: [8395157](#)).
 - 16 Stich O, Klages E, Bischler P, Jarius S, Rasiah C, Voltz R, Rauer S: SOX1 antibodies in sera from patients with paraneoplastic neurological syndromes. *Acta Neurol Scand* (2012) 125(5): 326 - 331 (PMID: [21751968](#)).
 - 17 Takamori M, Takahashi M, Yasukawa Y, Iwasa K, Nemoto Y, Suenaga A, Nagataki S, Nakamura T: Antibodies to recombinant synaptotagmin and calcium channel subtypes in Lambert-Eaton myasthenic syndrome. *J Neurol Sci* (1995); 133(1 - 2): 95 - 101 (PMID: [8583238](#)).
 - 18 Takamori M, Motomura M, Fukudome T, Yoshikawa H: Autoantibodies against M1 muscarinic acetylcholine receptor in myasthenic disorders. *Eur J Neurol* (2007); 14(11): 1.230 - 1.235 (PMID: [17764462](#)).
 - 19 Takamori M: Lambert-Eaton myasthenic syndrome: search for alternative autoimmune targets and possible compensatory mechanisms based on presynaptic calcium homeostasis. *J Neuroimmunol* (2008); 201 - 202: 145 - 52 (PMID: [18653248](#)).
 - 20 Titulaer MJ, Klooster R, Potman M, Sabater L, Graus F, Hegeman IM, Thijssen PE, Wirtz PW, Twijnstra A, Smitt PA, van der Maarel SM, Verschuuren JJ: SOX antibodies in small-cell lung cancer and Lam-



Autoanticorpi nelle malattie della giunzione neuromuscolare

- bert-Eaton myasthenic syndrome: frequency and relation with survival. *J Clin Oncol* (2009); 27(26): 4.260-4.267 (PMID: [19667272](#)).
- 21 Titulaer MJ, Maddison P, Sont JK, Wirtz PW, Hilton-Jones D, Klooster R, Willcox N, Potman M, Sillevs Smitt PA, Kuks JB, Roep BO, Vincent A, van der Maarel SM, van Dijk JG, Lang B, Verschuuren JJ: Clinical Dutch-English Lambert-Eaton Myasthenic syndrome (LEMS) tumor association prediction score accurately predicts small-cell lung cancer in the LEMS. *J Clin Oncol* (2011); 29(7): 902 - 908 (PMID: [21245427](#)).
- 22 Tomiyasu K, Ito H, Kanazawa N, Saito T, Kowa H: Anti-Hu antibody in a patient with Lambert-Eaton myasthenic syndrome and early detection of small cell lung cancer. *Intern Med* (1995); 34(11): 1.082 - 1.085 (PMID: [8774968](#)).
- 23 Vernino S, Lennon VA: New Purkinje cell antibody (PCA-2): marker of lung cancer-related neurological autoimmunity. *Ann Neurol* (2000); 47(3): 297 - 305 (PMID: [10716248](#)).
- 24 Verschuuren JJ, Dalmau J, Tunkel R, Lang B, Graus F, Schramm L, Posner JB, Newsom-Davis J, Rosenfeld MR: Antibodies against the calcium channel beta-subunit in Lambert-Eaton myasthenic syndrome. *Neurology* (1998); 50(2): 475 - 479 (PMID: [9484375](#)).

Neuromiotonia

- 1 Antozzi C, Frassoni C, Vincent A, Regondi MC, Andreetta F, Bernasconi P, Ciano C, Chang T, Cornelio F, Spreafico R, Mantegazza R: Sequential antibodies to potassium channels and glutamic acid decarboxylase in neuromyotonia. *Neurology* (2005); 64(7): 1.290 - 1.293 (PMID: [15824370](#)).
- 2 Fleisher J, Richie M, Price R, Scherer S, Dalmau J, Lancaster E: Acquired Neuromyotonia Heraldng Recurrent Thymoma in Myasthenia Gravis. *JAMA Neurol* (2013); (PMID: [23978943](#)).
- 3 Hart IK, Vincent V, Leys K, Laux V, Lorra C, Pongs O, Newsom-Davis J: Serum autoantibodies bind to voltage-gated potassium channels in acquired neuromyotonia. *Ann Neurol* (1994); 36, 325 (abstr).
- 4 Hart IK, Waters C, Vincent A, Newland C, Beeson D, Pongs O, Morris C, Newsom-Davis J: Autoantibodies detected to expressed K⁺ channels are implicated in neuromyotonia. *Ann Neurol* (1997); 41(2): 238 - 246 (PMID: [9029073](#)).
- 5 Hart IK: Acquired neuromyotonia: a new autoantibody-mediated neuronal potassium channelopathy. *Am J Med Sci* (2000) 319(4): 209 - 216 (PMID: [10768605](#)).
- 6 Illes Z, Vincent A, Kovacs GG, Merkli H, Tordai A, Komoly S, Nagy F: Acquired neuromyotonia precipitated by thyroid surgery and associated with antiacetylcholine receptor antibodies. *Eur Neurol* (2006); 55(4): 222 - 224 (PMID: [16778438](#)).
- 7 Irani SR, Alexander S, Waters P, Kleopa KA, Pettingill P, Zuliani L, Peles E, Buckley C, Lang B, Vincent A: Antibodies to Kv1 potassium channel-complex proteins leucine-rich, glioma inactivated 1 protein and contactin-associated protein-2 in limbic encephalitis, Morvan's syndrome and acquired neuromyotonia. *Brain* (2010); 133(9): 2.734 - 2.748 (PMID: [20663977](#)).
- 8 Kleopa KA, Elman LB, Lang B, Vincent A, Scherer SS: Neuromyotonia and limbic encephalitis sera target mature Shaker-type K⁺ channels: subunit specificity correlates with clinical manifestations. *Brain* (2006); 129(Pt 6): 1.570 - 1.584 (PMID: [16613892](#)).
- 9 Lancaster E, Huijbers MG, Bar V, Boronat A, Wong A, Martinez-Hernandez E, Wilson C, Jacobs D, Lai M, Walker RW, Graus F, Bataller L, Illa I, Marx S, Strauss KA, Peles E, Scherer SS, Dalmau J: Investigations of caspr2, an autoantigen of encephalitis and neuromyotonia. *J. Ann Neurol* (2011); 69(2): 303 - 311 (PMID: [21387375](#)).
- 10 Mygland A, Vincent A, Newsom-Davis J, Kaminski H, Zorzato F, Agius M, Gilhus NE, Aarli JA: Autoantibodies in thymoma-associated myasthenia gravis with myositis or neuromyotonia. *Arch Neurol* (2000); 57(4): 527 - 531 (PMID: [10768628](#)).
- 11 Pittock SJ, Lucchinetti CF, Parisi JE, Benarroch EE, Mokri B, Stephan CL, Kim KK, Kilimann MW, Lennon VA: Amphiphysin autoimmunity: paraneoplastic accompaniments. *Ann Neurol* (2005); 58(1): 96 - 107 (PMID: [15984030](#)).



Autoanticorpi nelle malattie della giunzione neuromuscolare

- 11a Simon NG, Reddel SW, Kiernan MC, Layzer R. Muscle-specific kinase antibodies: a novel cause of peripheral nerve hyperexcitability? *Muscle Nerve* (2013); 48(5): 819 - 823 (PMID: [23720161](#)).
- 12 Vernino S, Auger RG, Emslie-Smith AM, Harper CM, Lennon VA: Myasthenia, thymoma, presynaptic antibodies, and a continuum of neuromuscular hyperexcitability. *Neurology* (1999); 53(6): 1.233 - 1.239 (PMID: [10522878](#)).
- 13 Vernino S, Lennon VA: Ion channel and striational antibodies define a continuum of autoimmune neuromuscular hyperexcitability. *Muscle Nerve* (2002); (PMID: [12402293](#)).
- 14 Vincent A, Irani SR: Caspr2 antibodies in patients with thymomas. *J Thorac Oncol* (2010) 5(10 Suppl 4): S277 - S280 (PMID: [20859119](#)).

Sindrome di Morvan

- 1 Barber PA, Anderson NE, Vincent A: Morvan's syndrome associated with voltage-gated K⁺ channel antibodies. *Neurology* (2000); 54(3): 771 - 772 (PMID: [10680828](#)).
- 2 Díaz-Manera J, Rojas-García R, Gallardo E, Juárez C, Martínez-Domeño A, Martínez-Ramírez S, Dalmau J, Blesa R, Illa I: Antibodies to AChR, MuSK and VGKC in a patient with myasthenia gravis and Morvan's syndrome. *Nat Clin Pract Neurol* (2007); 3(7): 405 - 410 (PMID: [17611489](#)).
- 3 Halbach M, Hömberg V, Freund HJ. Neuromuscular, autonomic and central cholinergic hyperactivity associated with thymoma and acetylcholine receptor-binding antibody. *J Neurol* (1987); 234(6): 433 - 436 (PMID: [3655849](#)).
- 4 Kleopa KA, Elman LB, Lang B, Vincent A, Scherer SS: Neuromyotonia and limbic encephalitis sera target mature Shaker-type K⁺ channels: subunit specificity correlates with clinical manifestations. *Brain* (2006); 129(Pt 6): 1.570 - 1.584 (PMID: [16613892](#)).
- 5 Lai M, Huijbers MG, Lancaster E, Graus F, Bataller L, Balice-Gordon R, Cowell JK, Dalmau J: Investigation of LGI1 as the antigen in limbic encephalitis previously attributed to potassium channels: a case series. *Lancet Neurol* (2010); 9(8): 776 - 785 (PMID: [20580615](#)).
- 6 Lee EK, Maselli RA, Ellis WG, Agius MA: Morvan's fibrillary chorea: a paraneoplastic manifestation of thymoma. *J Neurol Neurosurg Psychiatry* (1998); 65(6): 857 - 862 (PMID: [9854961](#)).
- 7 Liguori R, Vincent A, Clover L, Avoni P, Plazzi G, Cortelli P, Baruzzi A, Carey T, Gambetti P, Lugaresi E, Montagna P: Morvan's syndrome: peripheral and central nervous system and cardiac involvement with antibodies to voltage-gated potassium channels. *Brain* (2001) 124(Pt 12): 2.417 - 2.426 (PMID: [11701596](#)).
- 8 Loukaides P, Schiza N, Pettingill P, Palazis L, Vounou E, Vincent A, Kleopa KA: Morvan's syndrome associated with antibodies to multiple components of the voltage-gated potassium channel complex. *J Neurol Sci* (2012) 312(1-2): 52 - 56 (PMID: [21906755](#)).
- 9 Vincent A: Antibodies to contactin-associated protein 2 (CASPR2) in thymoma and Morvan's syndrome. *Ann Neurol* (2009); 66: 3 - 3 (abstract).