



## Autoanticorpi anti-enolasi

### Indicazioni

- ▶ Esami di autoanticorpi per enolasi ( $\alpha$ -enolasi,  $\beta$ -enolasi,  $\gamma$ -enolasi) sono riservati agli studi e quesiti di ricerca a causa della loro specificità bassa.

### vedi

- ▶ [Autoanticorpi nelle sindromi neurologiche paraneoplastiche](#)
- ▶ [Autoanticorpi in malattie degli occhi](#)
- ▶ [Autoanticorpi in malattie dell'ipofisi](#)

### Antigene

Le enolasi (EC 4.2.1.11; fosfopiruvato idratasi) sono enzimi ubiquitari che catalizzano la conversione del 2-fosfoglicerato a fosfoenolpiruvato nella penultima tappa della conversione del glucosio in due molecole di piruvato. Nel uomo esistono cinque tipi differenti, costituiti ciascuno di un dimero delle tre subunità ( $\alpha$ -,  $\beta$ -,  $\gamma$ -enolasi) codificate da tre geni. La  $\alpha$ -enolasi è ubiquitaria nel citoplasma delle cellule, la  $\gamma$ -enolasi è specifica dei tessuti neuronali e la  $\beta$ -enolasi dei tessuti muscolari.

**$\alpha$ -Enolasi** (nome del gene ENO1, cromosoma 1p36.2, isoforma 1 (sequenza canonica), 434 aminoacidi (aa), Mr 47,2 kDa), chiamata anche enolasi 1, si trova in molteplici tipi dei tessuti (tipo  $\alpha\alpha$ -enolasi).

**$\beta$ -Enolasi** (nome del gene ENO3, cromosoma 17p13.2, isoforma 1 (sequenza canonica), 434 aa, Mr 46,9 kDa), chiamata anche enolasi 3, prevalente nel muscolo cardiaco e nel muscolo scheletrico (tipi  $\alpha\beta$ -enolasi o  $\beta\beta$ -enolasi).

**$\gamma$ -Enolasi** (nome del gene ENO2, cromosoma 12p13, isoforma 1 (sequenza canonica) 434 aa, Mr 47,3 kDa), chiamata anche enolasi neuronale specifica (NSE) o enolasi 2 (tipi  $\alpha\gamma$ -enolasi o  $\gamma\gamma$ -enolasi), prevalente in neuroni e cellule neuroendocrine (APUD) e nei tumori neuroendocrini, neoplasie che originano dalle cellule appartenenti al sistema neuroendocrino diffuso o confinato (APUD-oma).

### Prevalenza

Autoanticorpi anti-enolasi sono stati riscontrati in molteplici malattie (tabella 1). Possono reagire con le diverse subunità come l' $\alpha$ -subunità ubiquitaria o la  $\gamma$ -subunità neuronale specifica. Esistono anche anticorpi con reazioni crociate fra  $\beta$ -enolasi e  $\alpha$ -enolasi o fra tutte e tre le enolasi.



## Autoanticorpi anti-enolasi

**Tabella 1** Autoanticorpi anti-enolasi nelle diverse malattie

Malattie	Bibliografia
<b>Sistema nervoso centrale</b>	
Atassia cerebellare	Yamamoto et al. 2010
Sindrome di opsoclono-mioclono	Blaes et al. 2007 Kirsten et al. 2007
Sclerosi multipla	Forooghian et al. 2007 b Forooghian et al. 2007 a
<b>Malattie degli occhi</b>	
Retinopatia autoimmune	Ko et al. 2010 Adamus et al. 2009 Magrys et al. 2007 Ren und Adamus 2004
CAR, retinopatia cancro associata	Ejma et al. 2008 Misiuk-Hojto et al. 2007 Weleber et al. 2005 Dot et al. 2005 Adamus et al. 2004 Adamus et al. 1998 Adamus et al. 1996
Neurite ottica paraneoplastica	Saito et al. 2014
Glaucoma	Tsybikov et al. 2012 Ikeda et al. 2002 Maruyama et al. 2000
Degenerazione retinica	Braus et al. 2008
Degenerazione maculare	Adamus et al. 2014 Joachim et al. 2007
<b>Malattie dermatologiche</b>	
Vitiligine	Waterman et al. 2010
<b>Ghiandole endocrine</b>	
Ipfosite linfocitaria (LH), Ipofosite autoimmune	Falorni et al. 2014 Tanaka et al. 2003 O'Dwyer et al. 2002
Ipfosite linfocitaria associata a deficienza di ACTH	Bensing et al 2005
Sindrome di Sheehan	Goswami et al. 2002
Encefalopatia di Hashimoto	Yamaguchi et al. 2013 Yoneda et al. 2007 Fujii et al. 2005
Poliendocrinopatia autoimmune (APECED)	O'Dwyer et al. 2007
<b>Malattie del fegato, dell'intestino</b>	
Malattie infiammatorie croniche intestinali	Vermeulen et al. 2011 Vermeulen et al. 2008 Roosendaal et al. 1998
Cirrosi biliare primitiva, colangite sclerosante primitiva	Roosendaal et al. 2000 Orth et al. 1998 Akisawa et al. 1997
Fibrosi epatica	Peng et al. 2013



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Malattie	Bibliografia
<b>Malattie polmonari</b>	
Polmonite interstiziale	Barua et al. 2010
Asma bronchiale	Lee et al. 2008 Nahm et al. 2006
<b>Malattie renali</b>	
Nefropatia membranosa, glomerulonefrite membranosa	Murtas et al. 2012 Bruschi et al. 2011 Wakui et al. 1999
<b>Malattie dell'utero, dell'ovaio</b>	
Endometriosi	Nabeta et al. 2009 Walter et al. 1995
Insufficienza ovarica prematura	Edassery et al. 2010 Sundblad et al. 2006
<b>Malattie autoimmuni sistemiche, vasculite</b>	
Lupus eritematoso sistemico, nefrite lupica	Bruschiet al. 2015 Bruschi et al. 2014 Mosca et al. 2006 Migliorini et al. 2002 Pratesi et al. 2000
Blocco cardiaco congenito (madri dei bambini affetti)	Llanos et al. 2009
Vasculite sistemica autoimmune	Régent et al. 2014 Moodie et al. 1993
Vasculite crioglobulinemica	Lamprecht et al. 1998 Sabbatini et al. 1997
Morbo Behçet	Cho et al. 2010 Lee et al. 2009
Sindrome di Kawasaki	Chun et al. 2008
Artrite reumatica	Lee et al. 2015 Saulot et al. 2002
<b>Neoplasie</b>	
Colangiocarcinoma	Rucksaken et al. 2014
Microcitoma (SCLC)	He et al. 2007
Carcinoma squamoso della bocca, Gingivo-buccal oral squamous cell carcinoma (OSCC-GB)	Pranay et al. 2013 Shukla et al. 2007
Melanoma	Hiura et al. 2011 Suzuki et al. 2010
Carcinoma dell'ovario	Barua et al. 2009
Carcinoma del pancreas	Capello et al. 2015 Tomaino et al. 2011
Leucemia mieloide	Zou et al. 2005
<b>Altri</b>	
Policondrite ricorrente	Tanaka et al. 2006
Demenza con corpi di Lewy	Ikura et al. 2015
Schizofrenia	Deckmann et al. 2002
Pazienti psichiatrici	Janković et al. 1991 a
Dipendenti di eroina	Janković et al. 1991 b



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