

**Table 4. Paraneoplastic Neurological Syndromes and Tumor/Cancer Types Associated With Autoantibodies**

| Autoantibody target <sup>a</sup> | Associated neurological syndrome <sup>a</sup> |  |                         |                        |      |                   |                      |               |                    |              | Associated tumor or cancer type |               |                  |             |                |                |                 |                   |                  |         | Frequency of cancer(s) in Ab-positive PNS, % |                                 |
|----------------------------------|---|--|-------------------------|------------------------|------|-------------------|----------------------|---------------|--------------------|--------------|---------------------------------|---------------|------------------|-------------|----------------|----------------|-----------------|-------------------|------------------|---------|--|---------------------------------|
|                                  | Autonomic neuropathy                          | Brainstem encephalitis/opso-<br>clonus-myoclonus | Cerebellar degeneration | LE / Encephalomyelitis | LEMS | Myasthenia gravis | Neuromyelitis optica | Neuromyotonia | Sensory neuropathy | Stiff-person | Other                           | Breast cancer | Hodgkin lymphoma | Lung cancer | SCLC           | Ovarian cancer | Prostate cancer | Renal cell cancer | Testicular tumor | Thymoma |  | Other                           |
| AChR                             |   |  |                         |                        |      | •                 |                      |               |                    |              |                                 |               |                  |             |                |                |                 |                   |                  | ○       |  |                                 |
| AGNA (SOX1)                      |   |  | •                       | •                      | •    |                   |                      | •             |                    |              |                                 |               |                  |             |                |                |                 |                   |                  | •       |  |                                 |
| AMPA                             |   |  |                         | •                      |      |                   |                      |               |                    |              |                                 |               |                  |             |                |                |                 |                   |                  | •       |  |                                 |
| Amphiphysin                      |   | •  |                         | •                      |      |                   |                      | •             | •                  |              |                                 |               |                  |             |                |                |                 |                   |                  |         |  |                                 |
| ANNA1 (Hu)                       | •   | •  | •                       | •                      |      |                   |                      | •             |                    |              |                                 |               |                  |             |                |                |                 |                   |                  |         |  | Bladder, GI, pancreas           |
| ANNA2 (Ri)                       |   | •  | •                       |                        |      |                   |                      |               | •                  |              |                                 |               |                  |             |                |                |                 |                   |                  |         |  | Gynecological                   |
| ANNA3 <sup>b</sup>               |   |  |                         | •                      |      |                   |                      | •             |                    |              |                                 |               |                  |             |                |                |                 |                   |                  |         |  |                                 |
| Aquaporin 4 (NMO)                |   |  |                         |                        |      |                   | •                    |               |                    |              |                                 |               |                  |             |                |                |                 |                   |                  |         |  |                                 |
| CASPR2                           |   |  |                         | •                      |      |                   |                      | •             |                    | •            |                                 |               |                  |             |                |                |                 |                   |                  | ○       |  | Melanoma                        |
| CRMP5 (CV2)                      | •   | •  | •                       | •                      |      |                   |                      | •             |                    | •            |                                 |               |                  | ○           |                |                |                 |                   |                  | ○       |  |                                 |
| DPPX                             |   |  |                         | •                      |      |                   |                      |               |                    |              |                                 |               |                  |             |                |                |                 |                   |                  |         |  | B-cell                          |
| GABA <sub>B</sub> R              |   |  |                         | •                      |      |                   |                      |               |                    |              |                                 |               | • <sup>e</sup>   | ○           |                |                |                 |                   |                  |         |  |                                 |
| gAChR                            | •   |  |                         |                        |      |                   |                      | •             |                    | •            |                                 |               |                  |             |                | •              | •               |                   |                  | •       |  | GI, lymphoid, melanoma, bladder |
| GAD65                            |   |  | •                       | •                      |      |                   |                      |               | •                  |              |                                 |               |                  |             |                |                |                 |                   |                  | •       |  | Pancreas, thymus                |
| LG11                             |   |  |                         | •                      |      |                   |                      |               |                    |              |                                 |               |                  |             |                |                | •               |                   |                  |         |  | Nonmelanoma skin, colon         |
| Ma2/Ta                           |   | •  | •                       | •                      |      |                   |                      |               |                    |              |                                 |               |                  |             |                |                |                 |                   | ○                |         |  |                                 |
| MAG                              |   |  |                         |                        |      |                   |                      | •             |                    |              |                                 |               |                  |             |                |                |                 |                   |                  |         |  | MGUS <sup>e</sup>               |
| NMDAR1                           |   |  |                         |                        |      |                   |                      |               |                    |              |                                 |               |                  |             | ○ <sup>e</sup> |                |                 |                   | • <sup>e</sup>   |         |  |                                 |
| PCA1 (Yo)                        |   |  | •                       |                        |      |                   |                      |               |                    |              |                                 |               |                  |             | ○              |                |                 |                   |                  |         |  |                                 |
| PCA2 <sup>b</sup>                |   |  | •                       | •                      |      |                   |                      | •             |                    |              |                                 |               |                  | •           |                |                |                 |                   |                  |         |  |                                 |
| PCA-Tr (DNER)                    |   |  | •                       |                        |      |                   |                      |               |                    |              |                                 |               |                  |             |                |                |                 |                   |                  |         |  |                                 |
| Recoverin                        |   |  |                         |                        |      |                   |                      |               |                    |              |                                 |               |                  | ○           |                |                |                 |                   |                  |         |  |                                 |
| RyR                              |   |  |                         |                        |      |                   | •                    |               |                    |              |                                 |               |                  |             |                |                |                 |                   |                  | ○       |  |                                 |
| Striated muscle                  |   |  |                         |                        |      |                   | •                    |               |                    |              |                                 |               |                  |             |                |                |                 |                   |                  | ○       |  |                                 |
| Titin                            |   |  |                         |                        |      |                   | •                    |               |                    |              |                                 |               |                  |             |                |                |                 |                   |                  | ○       |  |                                 |
| VGCC, N-type                     |   |  |                         |                        | •    |                   |                      |               |                    |              |                                 |               |                  | ○           |                |                |                 |                   |                  |         |  |                                 |
| VGCC, P/Q-type                   |   |  | •                       |                        | •    |                   |                      |               |                    |              |                                 |               |                  | ○           |                |                |                 |                   |                  |         |  |                                 |
| VGKC                             |   |  |                         | •                      |      |                   | •                    |               |                    | •            |                                 |               |                  | •           |                |                |                 |                   |                  | •       |  |                                 |
| Zic4                             |   |  | •                       |                        |      |                   |                      |               |                    |              |                                 |               |                  | ○           |                |                |                 |                   |                  |         |  |                                 |

Ab, autoantibody; GI, gastrointestinal; LE, limbic encephalitis; LEMS, Lambert-Eaton myasthenic syndrome; MGUS, monoclonal gammopathy of uncertain significance; PNS, paraneoplastic neurological syndrome; SCLC, small-cell lung cancer.<sup>3,4,14-17,19-22,24,27-49</sup>

• indicates tumor type(s) associated with the antibody; ○ indicates tumor type(s) most frequently associated with the antibody.

<sup>a</sup> Autoantibodies and syndromes can occur in the absence of cancer or a tumor.

<sup>b</sup> Case report.

<sup>c</sup> Other reported syndromes: CASPR2, Morvan syndrome; CRMP5 (CV2), chorea and optic neuritis; gAChR, cortical and neuropsychiatric presentation; NMDAR1, encephalitis with psychiatric manifestations, seizures, dyskinesias, dystonia, and autonomic instability; recoverin, cancer-associated retinopathy; VGKC, Morvan syndrome.

<sup>d</sup> For Morvan syndrome; LE is almost always nonparaneoplastic.

<sup>e</sup> Notes on cancers: GABA<sub>B</sub>R, lung tumor; MAG, MGUS is not cancer but can progress to cancer; NMDAR1, teratoma.

<sup>f</sup> For LEMS.

<sup>g</sup> For rapid cerebellar syndrome.