Giulia Berzero, MD
Yael Hacohen, MD
Lars Komorowski, PhD
Madeleine Scharf, PhD
Caroline Dehais, MD
Delphine Leclercq, MD
Virginie Fourchotte, MD
Bruno Buecher, MD, PhD
Jérôme Honnorat, MD, PhD
Francesc Graus, MD, PhD
Jean-Yves Delattre, MD
Dimitri Psimaras, MD

Neurol Neuroimmunol Neuroinflamm
2017;4:e326; doi: 10.1212/NXI.0000000000000326

PARANEOPLASTIC CEREBELLAR DEGENERATION ASSOCIATED WITH ANTI-ITPR1 ANTIBODIES

OPEN

In recent years, the spectrum of anti-Purkinje cell autoimmunity has widened to include novel clinico-immunologic entities, a number of which have been associated with antibodies targeting intracellular antigens (protein kinase C gamma (PKCγ), carbonic anhydrase–related protein (CARP VIII), Ca/Rho GTPase activating protein 26 (ARHGAP26), inositol 1,4,5-trisphosphate receptor 1 (ITPR1), and HOMER3).[1–3] Anti-ITPR1 belong to this group of newly discovered anticerebellar autoantibodies,[4] but little is known regarding the exact clinical and paraclinical phenotypes associated with these antibodies and their potential association with cancer.

Here, we report a young woman, carrier of a detrimental germline mutation in the *BRCA1* gene, who at the age of 28 years developed autoimmune cerebellar ataxia associated with anti-ITPR1 antibodies with no associated malignancy, but 11 years later was diagnosed with a breast cancer with ITPR1 expression detected on the tumor.

Case report. A 31-year-old Martinican woman was investigated in view of a 3-year history of subtly progressive ataxia. Neurologic examination revealed a static-kinetic cerebellar syndrome characterized by moderate gait ataxia and mild dysarthria. In addition, she was obese and had arterial hypertension. There was no history of excess alcohol intake. She had no family history of neurologic disease but a history of breast cancer in her maternal side. Brain MRI revealed pontocerebellar atrophy with hot cross bun sign, without any other supratentorial or infratentorial abnormalities (figure 1, A-B). There was no evidence of peripheral neuropathy on electroneuromyography. The CSF was acellular with normal glucose and protein levels and no oligoclonal bands. Extensive investigation for underlying infective, autoimmune, and metabolic etiologies was negative with the exception of high-titer anti-Purkinje cell autoantibodies detected by indirect immunohistochemistry[4] in both the serum (titer 1/32,000) and the CSF (titer 1/1,000). All specific testing for known CNS autoantibodies were negative.[4] Comprehensive tumor screening by total-body 18-fluoro-deoxyglucose PET (^{18}FDG-PET), bone marrow biopsy, and dermatologic and gynecologic explorations revealed no occult malignancy. She received 6 cycles of high-dose IV methylprednisolone (1 g/d for 3 days), followed by 10 sessions of plasma exchange, without clinical improvement. She continued to have regular tumor screening with total-body ^{18}FDG-PET.

Over the following 2 years, her neurologic status worsened, and she became unable to walk unassisted. CSF analysis and neuroimaging were unchanged. Three cycles of IV immunoglobulin (2 g/kg) were attempted, without clinical benefit. Thereafter, she stabilized but remained severely disabled. Anti-Purkinje cell autoantibodies were persistently positive in the serum and were later characterized as anti-ITPR1 antibodies.[4]

Following familial genetic counseling, she was tested positive for a detrimental germline mutation in the *BRCA1* gene that was first identified in a relative affected with breast cancer (figure e-1 at Neurology.org/nn), and she thus entered a dedicated screening program for breast and ovarian cancers.

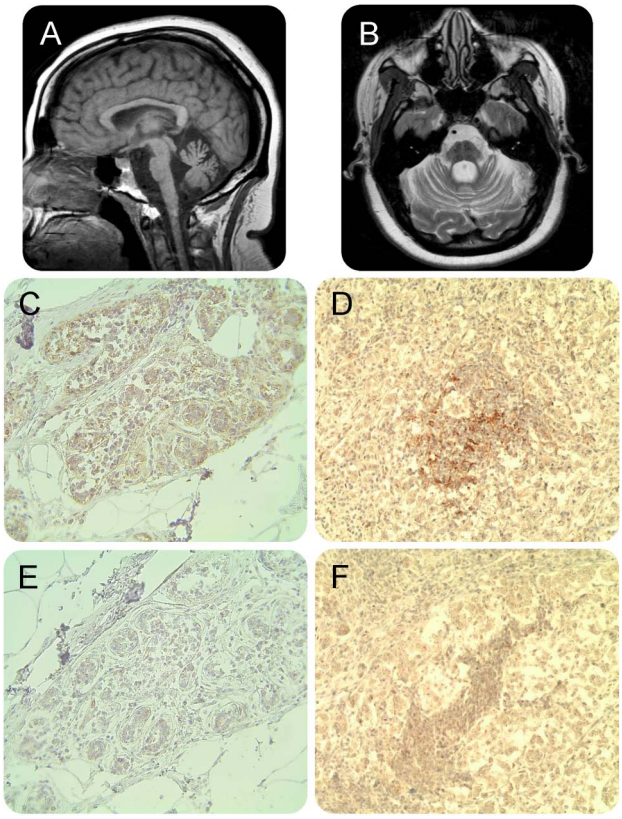
Six years later, a suspicious lymph node was detected on mammography. She underwent radical right mastectomy, revealing a bifocal ductal carcinoma (grade I; estrogen-receptor–positive (ER+) 100%, progesterone-receptor–positive (PR+) 90%, Her2/neu−), with 2 intramammary and 1 axillary metastatic lymph nodes. Immunopathology revealed substantial ITPR1 expression in both the breast tumor and the metastatic lymph nodes (figure 1, C-F). Local radiotherapy was considered unfeasible because of her comorbidities, and adjuvant tamoxifen was introduced. At 6-month follow-up, she was considered in tumor remission; her neurologic status was unchanged.

Discussion. Here, we report the case of a young woman presenting with autoimmune cerebellar ataxia and anti-ITPR1 antibodies, who 11 years after onset was diagnosed with breast cancer. Both the breast tumor and metastatic lymph nodes expressed ITPR1, suggesting that the long-standing cerebellar autoimmunity was in fact paraneoplastic.

So far, only 4 cases of cerebellar ataxia related to anti-ITPR1 autoimmunity have been published,[4]

Supplemental data at Neurology.org/nn

Figure 1 MRI features and immunopathology



MRI features (A, B). Brain MRI obtained in 2007 showed an already severe pontocerebellar atrophy in sagittal T1- (A) and axial T2- (B) weighted images. Hot cross bun sign, marked enlargement of cerebellar sulci, fourth ventricle, and basal cisternae are evident in T2-weighted images (B). Immunopathology (C–F). Patient's breast cancer specimen (C, E) incubated with anti–inositol 1,4,5-trisphosphate receptor 1 (ITPR1) rabbit commercial antibody 1:1,000 (C) and control rabbit serum (E). The lymph node metastasis specimen (D, F) incubated with anti-ITPR1 rabbit commercial antibody 1:1,000 (D) and control rabbit serum (F). Magnification ×200.

and tumor association is limited to the present case. To date, it is thus impossible to draw any conclusion regarding the possible association of anti-ITPR1 antibodies to cancer. Still, ITPR1 is expressed in a number of tumors such as breast and liver cancers, melanomas, and lymphomas,[5] and we thus expect anti-ITPR1 autoimmunity to potentially associate with these tumor types.

Our patient was diagnosed with breast cancer 11 years after the onset of the cerebellar syndrome, far longer than ever reported.[6] Cancer was diagnosed while still subclinical, during scheduled assessments, within a BRCA1 tumor surveillance program that was established by oncologists. Our case underlines the importance for neurologists to carefully evaluate individual cancer risk in all patients with autoimmunity to intracellular antigens.

From the AP-HP Pitié-Salpêtrière (G.B., C.D., J.-Y.D., D.P.), Service de Neurologie Mazarin, Paris, France; Neuroscience Consortium (G.B.), University of Pavia, Monza Policlinico and Pavia Mondino, Italy; Nuffield Department of Clinical Neurosciences (Y.H.), John Radcliffe Hospital, University of Oxford, United Kingdom; Institute of Experimental Immunology (L.K., M.S.), affiliated to Euroimmun AG, Lübeck, Germany; AP-HP Pitié-Salpêtrière (D.L.), Service de Neuroradiologie; Département de Chirurgie Oncologique (V.F.); Département de Biologie des Tumeurs (B.B.), Service Génétique, Institut Curie, Paris; Centre National de Référence pour les Syndromes Neurologiques Paranéoplasiques (J.H.), Hospices Civils de Lyon, Institut NeuroMyoGene INSERM U1217/CNRS UMR 5310, Université de Lyon, France; and Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS) (F.G.), Service of Neurology, Hospital Clinic, Barcelona, Spain.

Author contributions: G.B.: study design, data collection, analysis and interpretation, and manuscript drafting and revision. Y.H., L.K., M.S., C.D., D.L., V.F., B.B., J.H., F.G., and J.-Y.D.: analysis and interpretation of the data, and manuscript revision. D.P.: study design, data collection, analysis and interpretation of the data, and manuscript revision.

Study funding: No targeted funding.

Disclosures: G. Berzero reports no disclosures. Y. Hacohen received research support from NIHR, University of Oxford, and NHS Trust. L. Komorowski is employed by EUROIMMUN AG. M. Scharf holds a patent for a diagnostic test for the detection of autoantibodies against ITPR1 and is employed by EUROIMMUN Medizinische Labordiagnostika AG. C. Dehais, D. Leclercq, V. Fourchotte, B. Buecher, and J. Honnorat report no disclosures. F. Graus is on the editorial board of Lancet Neurology *and receives licensing fees from EUROIMMUN for the use of IgLON5 as a diagnostic test. J.-Y. Delattre is on the editorial board of* The Oncologist *and receives research support from Institut National du Cancer. D. Psimaras reports no disclosures. Go to Neurology.org/nn for full disclosure forms. The Article Processing Charge was paid by the authors.*

Received November 8, 2016. Accepted in final form December 8, 2016.

Correspondence to Dr. Psimaras: dimitri.psimaras@aphp.fr

1. Jarius S, Wildemann B. "Medusa-head ataxia": the expanding spectrum of Purkinje cell antibodies in autoimmune cerebellar ataxia: part 1: anti-mGluR1, anti-Homer-3, anti-Sj/ITPR1 and anti-CARP VIII. J Neuroinflammation 2015;12:166.
2. Jarius S, Wildemann B. "Medusa head ataxia": the expanding spectrum of Purkinje cell antibodies in autoimmune cerebellar ataxia: part 2: anti-PKC-gamma, anti-GluR-delta2, anti-Ca/ARHGAP26 and anti-VGCC. J Neuroinflammation 2015;12:167.
3. Jarius S, Wildemann B. "Medusa head ataxia": the expanding spectrum of Purkinje cell antibodies in autoimmune cerebellar ataxia: part 3: anti-Yo/CDR2, anti-Nb/AP3B2, PCA-2, anti-Tr/DNER, other antibodies, diagnostic pitfalls, summary and outlook. J Neuroinflammation 2015; 12:168.
4. Jarius S, Scharf M, Begemann N, et al. Antibodies to the inositol 1,4,5-trisphosphate receptor type 1 (ITPR1) in cerebellar ataxia. J Neuroinflammation 2014;11:206.
5. Uhlén M, Fagerberg L, Hallström BM, et al. Tissue-based map of the human proteome. Science 2015;347: 1260419.
6. Ducray F, Demarquay G, Graus F, et al. Seronegative paraneoplastic cerebellar degeneration: the PNS Euronetwork experience. Eur J Neurol 2014;21:731–735.

Paraneoplastic cerebellar degeneration associated with anti-ITPR1 antibodies

Giulia Berzero, Yael Hacohen, Lars Komorowski, et al.

Neurol Neuroimmunol Neuroinflamm 2017;4;
DOI 10.1212/NXI.0000000000000326