WriteClick: Editor's Choice

Editors' Note: Two WriteClick submissions this week referenced Teaching NeuroImages. In response to an image purported to show reversible splenial cytotoxic edema due to acute mountain sickness resulting in a seizure, Dr. Schommer et al. make the case that the splenial edema was the result of the seizure, not the cause. In reference to the image entitled "TIA from an air embolism," Dr. Coebergh and colleagues rationalize that the most probable etiology was a retrograde venous air embolism. The authors agree with their judgment. Dr. Stroet et al. point out that the unexpectedly high incidence of therapy-related acute myeloid leukemia (TRAL) in the study by Martinelli et al. may be due to differences in treatment protocols in Italy vs Germany. The authors agree that there is variability in the incidence of TRAL, across centers and studies, and suggest that in this case it may be due to a larger sample size and longer follow-up time than is typical.

Megan Alcauskas, MD, and Robert C. Griggs, MD

TEACHING NEUROIMAGES: REVERSIBLE SPLENIAL CYTOTOXIC EDEMA IN ACUTE MOUNTAIN SICKNESS

Kai Schommer, Peter Bärtsch, Heidelberg; Michael Knauth, Kai Kallenberg, Goettingen, Germany: Drs. Bin and Lee reported a reversible cytotoxic edema in the splenium of the corpus callosum (SCC) in a healthy woman who had a seizure 1 day after a 6-day sojourn (4,000 m) in Tibet.[1] She also experienced mild symptoms of acute mountain sickness (AMS).

The authors suggested that the seizure was a manifestation of AMS since the same location of the cerebral edema had been reported in AMS.[2] This conclusion conflicts with previous reports. Seizure is not a symptom of AMS and may occur very rarely in combination with high-altitude cerebral edema.[3] In addition, AMS disappears rapidly with descent and cerebral MRI in AMS showed no visible edema and only a nonsignificant decrease of ADC in the SCC.[2]

Finally, a "reversible splenial lesion syndrome" is a distinct radiologic syndrome associated with several disorders.[4] In epilepsy, a reversible diffusion restriction in the SCC has been described.[5] The presented cytotoxic edema in the SCC is probably not related to AMS, but to the seizure itself, and we propose renaming the case report "Reversible splenial cytotoxic edema following epileptic seizure."

1. Bin CH, Lee SJ. Reversible splenial cytotoxic edema in acute mountain sickness. Neurology 2011;77:e94.
2. Kallenberg K, Bailey DM, Christ S, et al. Magnetic resonance imaging evidence of cytotoxic cerebral edema in acute mountain sickness. J Cereb Blood Flow Metab 2007;27:1064–1071.
3. Wilson MH, Newman S, Imray CH. The cerebral effects of ascent to high altitudes. Lancet Neurol 2009;8:175–191.
4. Garcia-Monco JC, Martinez A, Brochado AP, Saralegui I, Cabrera A, Beldarrain MG. Isolated and reversible lesions of the corpus callosum: a distinct entity. J Neuroimaging 2010;20:1–2.
5. Gallucci M, Limbucci N, Paonessa A, Caranci F. Reversible focal splenial lesions. Neuroradiology 2007;49:541–544.

TEACHING NEUROIMAGES: TIA FROM AN AIR EMBOLISM

Jan A. Coebergh, the Hague; Gert J. Lammers, Mark C. Kruit, Leiden, the Netherlands: The CT scan in this Teaching NeuroImage[1] proves the presence of air in the cavernous sinus. The most plausible explanation for this is a retrograde venous air embolism from the port-a-catheter with the patient in a vertical position. Retrograde venous cerebral embolism may lead to focal or generalized venous congestion, venous brain infarction, or even death. It is not credible that paradoxical arterial air emboli would have coalesced in the cavernous sinus after passing through brain capillaries.

Whether the acute clinical picture in this case can be explained by retrograde venous cerebral air embolism remains unclear. Theoretically, in this patient both paradoxical (antegrade) arterial air and (retrograde) venous air embolism may have occurred. If this were the case, the CT image only illustrates the

venous part of the story. Unimaged arterial air may have led to a small but strategic lacunar lesion (e.g., in the internal capsule) that was not visualized on diffusion-weighted MRI.

Author Response: Andrew J. Westwood, Thanh N. Nguyen, Boston: Coebergh et al. agree that the most plausible mechanism for air in the cavernous sinus is a retrograde venous embolism. In reviewing our article, we concur that the discussion may be misleading; we used the term TIA to denote a clinical syndrome which resolved within 1 hour rather than to referring to a proposed mechanism.

We know that the patient was sitting upright at the time. Because air is less dense than blood, it is possible that the embolism traveled retrogradely to produce the transient symptoms. On review of the catheter placement seen on chest x-ray at time of admission, the line appears to be placed with the tip in the superior vena cava. We refer to a study[2] that monitored paradoxical emboli in patients with transatrial shunts after central line placements. The head CT shows presence of air in the sinus and makes it more likely that it was retrograde. However, paradoxical air embolism should always be considered in patients with transatrial shunts. We thank Coebergh et al. for raising this important issue.

1. Westwood AJ, Nguyen TN. Teaching Neuro*Images*: TIA from an air embolism. Neurology 2011;77:123.
2. Engelhardt M, Folkers W, Brenke C, et al. Neurosurgical operations with the patient in sitting position: analysis of risk factors using transcranial Doppler sonography. Br J Anaesth 2006;96:467–472.

ACUTE MYELOID LEUKEMIA IN ITALIAN PATIENTS WITH MULTIPLE SCLEROSIS TREATED WITH MITOXANTRONE

Anke Stroet, Ralf Gold, Andrew Chan, Bochum, Germany: Martinelli et al.[1] reported a relatively large incidence of therapy-related acute myeloid leukemia (TRAL) in a retrospective Italian MS cohort (0.93%). In contrast, we observed a much lower TRAL incidence in a large retrospective German cohort (range of 0.25% to 0.41%)[2] similar to 2 prospective studies,[3,4] despite observation intervals comparable to Martinelli et al. In addition to methodologic aspects, differences may also relate to other factors including pretreatment and treatment protocols.

A 3-month treatment regimen is common in Germany, as demonstrated in one pivotal phase III trial[5]; 68.9% of the Italian patients were treated bimonthly or monthly. In addition, dose adjustment—according to leukocyte nadir—is not described in the Italian study but is required per the Summary of Product Characteristics in Germany. It is conceivable that higher dosages over a shorter time may pose an increased risk for toxicity. Potentially additive or genotoxic cotreatment further complicates data analysis. Besides the introduction of uniform treatment algorithms, larger collaborative studies should focus on potential risk factors as well as individual predisposition, e.g., pharmacogenomic characteristics.

This is important since treatment alternatives are still sparse in rapidly progressing secondary progressive MS.

Author Response: Vittorio Martinelli, Laura Straffi, Giancarlo Comi, Milan, Italy: We agree that there is variability in TRAL incidence in patients with MS. We observed this in our multicenter study[1] where TRAL incidence among centers ranged from 0/167 to 4/115. It is also recognized that published single cohort studies may be more biased toward high incidence than unpublished data.

Our data contradict other studies[2–4] with similar observational follow-up, but there were methodologic differences, including sample size (3,220[1] vs 1,156[2] or 802[3]); follow-up of at least 1 year; and the closely linked network of Italian centers. Furthermore, 2 new acute myeloid leukemia cases were confirmed in the last year in our original cohort.

As Chan et al. suggest, we suspect that risk might be related to a specific treatment regimen or cotreatment, but we did not find this association. Moreover, monthly[3] and 3-monthly infusions[2] appear to have similar incidences. We believe that without a means of identifying susceptibility,[6] the risk of TRAL must always be considered, perhaps with some type of "regional" stratification. There are currently 106 cases reported worldwide, one-third of which may be fatal.

1. Martinelli V, Cocco E, Capra R, et al. Acute myeloid leukemia in Italian patients with multiple sclerosis treated with mitoxantrone. Neurology 2011;77:1887–1895.
2. Stroet A, Starck M, Zettl U, et al. Incidence of therapy-related acute leukemia in mitoxantrone-treated multiple sclerosis patients in Germany. Ther Adv Neurol Disord (in press 2012).
3. Le Page E, Leray E, Edan G. Long-term safety profile of mitoxantrone in a French cohort of 802 multiple sclerosis

patients: a 5- year prospective study. Mult Scler 2011;17: 867–875.
4. Rivera V, Weinstock-Guttman B, Beagan J, Al-Sabbagh A, Bennett R, Dangond F. Final results from Registry to Evaluate Novantrone Effects in Worsening Multiple Sclerosis Study (RENEW). Mult Scler 2009;15:S254.
5. Hartung HP, Gonsette R, Konig N, et al. Mitoxantrone in progressive multiple sclerosis: a placebo-controlled, double-blind, randomized, multicenter trial. Lancet 2002;360:2018–2025.
6. Joannides M, Mays AN, Mistry AR, et al. Molecular pathogenesis of secondary acute promyelocytic leukemia. Mediterr J Hematol Infect Dis 2011;3: e2011045.

Author disclosures are available upon request (journal@neurology.org).

Teaching Neuro*images*: TIA from an air Embolism

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