

## CORRESPONDENCE



## European *Echinococcus multilocularis* Identified in Patients in Canada

**TO THE EDITOR:** Human alveolar echinococcosis is a potentially serious parasitosis caused by the tumorlike larval multiplication of the tapeworm *Echinococcus multilocularis*. The infection, which usually involves the liver and metastatic spread to distant organs, follows accidental ingestion of parasite eggs released into the environment with the feces of wild and domestic canids. Although this disease has been on the rise in Europe and Asia in recent decades, few cases of locally acquired human alveolar echinococcosis have been confirmed in North America. It has been presumed that the North America strains are less virulent than the Asian and European variants.<sup>1</sup>

In 2012, the European strain was detected in wildlife in western Canada.<sup>2</sup> In 2013, at the Alberta Provincial Laboratory for Public Health, we identified a human case of alveolar echinococcosis.<sup>3</sup> Since 2016, six more human cases of alveolar echinococcosis have been identified (see the Supplementary Appendix, available with the full text of this letter at NEJM.org). All the patients presented with hepatic lesions. Two of the patients had abdominal pain or swelling, which resulted in the diagnosis of alveolar echinococcosis on imaging; other diagnoses were based on surgical excision of a presumptive metastatic

lesion in one patient and on incidental findings on imaging performed for unrelated reasons in four patients. Three of the patients were receiving immunosuppressive medications, which probably facilitated the development of the parasites.<sup>4</sup> The diagnosis of these cases resulted in an estimated annual incidence of 0.059 cases per 100,000 inhabitants, an incidence that is similar to those recorded in endemic areas of Europe.<sup>4</sup>

Local acquisition of these infections was postulated on the basis of the patients' travel and exposure histories and on genotyping of the parasite strain. Using sequence analysis of mitochondrial DNA,<sup>2</sup> we compared parasitic genotypes responsible for human infections with genotypes of *E. multilocularis* specimens that had been collected from 77 local animal hosts, including wild canids, domestic dogs, and rodents. (Details are provided in the Supplementary Appendix.) In the animal hosts, three new *E. multilocularis* strains (ECA, EAB, and ESK) were detected (Fig. 1). These strains resembled the E4 strain found in Austria (AB461395.1) but were distinct because of the presence of three single-nucleotide polymorphisms. The ECA strain, which is unique to Canada and was present in 66 of 77 specimens of wildlife, was detected in five of seven patients with alveolar echinococcosis whose tissues were suitable for sequencing of parasite larvae, a finding that indicates local transmission. Although parasitic genotyping was not possible in samples obtained from one of the patients because of poor DNA quality, the patient's travel history indicated likely local acquisition. We also found that the patient in whom alveolar echinococcosis had been diagnosed in 2013 had been infected with a European strain of the parasite (see the Supplementary Appendix). However, further characterization of the strain was not possible, and the patient's

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**Figure 1. Genetic Relationship between Historic and Newly Identified Strains of *Echinococcus multilocularis*, According to Geographic Location.**

Panel A shows the genetic relationship among the previously described strains of *Echinococcus multilocularis* worldwide in the GenBank sequence database and the newly identified endemic strains (ECA, EAB, and ESK) in 77 parasite specimens obtained from the animal reservoir in Alberta and southern Saskatchewan in Canada. One of these strains (ECA, shown in red) caused at least five of seven cases of human alveolar echinococcosis that were diagnosed from 2013 to 2018 in Alberta on the basis of histopathological, serologic, and polymerase-chain-reaction assays. The other North American samples were previously described in specimens obtained in the United States. Panel B shows the phylogenetic tree inferred by partitioned Bayesian analysis performed on concatenated mitochondrial DNA, with the use of *E. granulosus* as an outgroup. The 0.002 scale bar denotes the genetic distance in nucleotide substitutions per site.

travel history, although suggestive of local acquisition, was not conclusive.

These data support the hypothesis that the establishment of a European-like strain of *E. multilocularis* in animal hosts in Canada may result in the emergence of human alveolar echinococcosis in North America.

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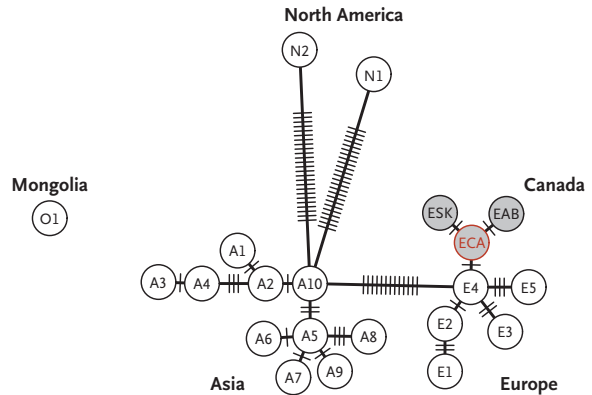
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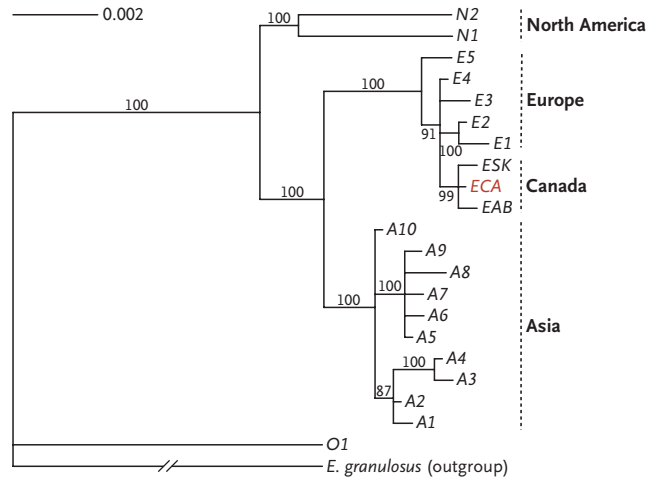
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**A Genetic Relationship among *Echinococcus multilocularis* Strains**



**B Phylogenetic Tree**



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