TBE NEWS

HIGH RISK OF TBE INFECTION AMONG NON-VACCINATED INDIVIDUALS IN A HIGHLY VACCINATED POPULATION

Background:

Before the introduction of the TBE vaccine in Austria, the annual number of reported cases was in the range of 300 to 700. After the implementation and broad use of TBE vaccine (80% vaccine coverage), cases decreased to a range of 40-130 in the years 1995 to 2017. Since 2018, the number of reported cases has been increasing and has never been below the number of 100 (e.g. 132 cases in 2025, see Newsletter February 2026). The reason for this trend remains unknown. Seroprevalence studies based on the detection of antibodies directed against glycoprotein E of the virus are not sufficient because the used antibody detection assays (ELISAs) cannot discriminate between antibodies raised against vaccine-inducted and infection-induced immune response.

However, with the use of a newly developed assay, which detects antibodies to the non-structural protein 1 (NS1) of TBE virus, this discrimination is possible (Newsletter April 2020), because long-lasting NS1 antibodies are only produced upon infection by TBE virus, but not upon vaccination as the vaccine does not contain NS1 (or only minimal amounts (Newsletter February 2020).

A TBE seroprevalence study was carried out based on samples from blood donors (March to April 2023) in Upper Austria, in which TBE virus glycoprotein E and NS1 antibodies were measured. A positive NS1-IgG antibody indicates a past infection by TBE virus, which may also have occurred prior to TBE vaccination. In very rare cases, it may indicate a TBE vaccine breakthrough infection.

Results:

A total of 2162 sera from residents in the federal state of Upper Austria were analyzed and met all inclusion criteria. Of these 2162 sera, 1925 (89%) reacted positive or borderline in the TBE IgG ELISA screening, indicating either an infection by TBE virus, TBE vaccination or cross-reaction to another flavivirus. Among these, 32/2162 TBE IgG positive sera also reacted positive in the NS1 assay, indicating a past infection by TBE virus. If these were subtracted from the 1925 TBE IgG positive samples, a total of 1893 /2162 of all blood donors showed evidence of TBE vaccination (87%). In addition, 237/2162 (11%) comprising 237 individuals without evidence of infection or vaccination and 32 individuals with evidence of past infection.. Thus, the total number of non-infected persons was 269/2162 (12%) comprising 237 individuals without evidence of infection or vaccination and 32 individuals with evidence of past infection.. The TBE virus infection prevalence was 32/269 (12%). Presuming that NS1-IgG antibodies persist up to 20 years after acute TBE virus infection, these results indicate that non-vaccinated inhabitants of Upper Austria may have a risk of infection of 12% within 20 years or 0.6% per year living in this TBE endemic area.

The vaccination rate for males was calculated to 88%, and the infection rate to 1.6% in the total male population. In the non-vaccinated male population, the infection rate was 13%. Of the female blood donors, 88% showed evidence of vaccination and 1.2% indicated a past infection by TBE virus. Among the non-vaccinated female blood donors, the infection rate was 10%.

The rate of non-vaccinated persons decreased from 21% in the age group 18-19 years to below 10% in the group aged 50-54 years and these increases to more than 20% in higher age groups.

There were also district-specific differences in the vaccination rates and in the NS1-IgG prevalence. Vaccination rates ranged from 68.6% (Braunau) to 100% in the city of Wels.

Assuming that the risk of infection by TBE virus is similar in blood donors and non-donors, the prevalence for the whole population results in a total of about 23,000 human infections for the whole population of Upper Austria within 20 years (based on the number of 32 NS1-IgG positives among 2162 blood donors).

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The calculated incidence of the non-vaccinated population results in an incidence of 594/100,000. The incidence of notified TBE cases in Upper Austria is 2.1 per 100,000 inhabitants, and thus, the manifestation index (percentage of infected individuals who develop clinical symptoms) is at 2.8% when using the total population as at-risk population, regardless of being vaccinated or not. Using the non-vaccinated proportion as the susceptible at-risk population, the MI is 0.35%.

Discussion:

This study showed evidence of a continuing high risk of infection by TBE virus in Upper Austria. The non-vaccinated population has an eightfold higher infection prevalence compared to the whole population.

In this study, the age group 19-24 years and older individuals (60 to 69 years) showed a significantly lower protection rate of about 80%, indicating that younger blood donors did not get vaccinated and that in older individuals, protective antibodies are waning. This implies that more younger persons should get their primary vaccination, and older age groups should be stimulated to get their booster shots.

In the past, it was generally estimated that the MI was in the range of 10%. This study disclosed that the MI is much smaller and that the rate of infections with no or sub-clinical symptoms is much higher than previously thought.

The highest infection rates in Upper Austria were observed in lowland areas along the border of the Czech Republic (a TBE high risk area). The reason for the increase in human cases in recent years remains unclear. An explanation for this observation might include changes in human behavior and/or in the circulation and transmission cycle of TBE virus due to environmental changes.

Literature:

Dobler et al.
Infection and vaccination-induced tick-borne encephalitis virus IgG antibody prevalence in the Austrian Federal State of Upper Austria, a high-risk region for TBEV *Epidemiologia.* 2026;7:35. doi:10.3390/epidemiologia7020035

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