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Driving eligibility for group 1 and 2 licenses after an acute symptomatic seizure due to a structural brain lesion – English Version

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Comment to

Holtkamp M, Breuer E, Gaus V, Lehmann R, Siebert E, Steinbart D, Vorderwülbecke B (2022) Driving eligibility following acute symptomatic seizure with structural brain lesion – English Version. Z Epileptol. https://doi.org/10.1007/s10309-022-00485-w

As Co-chairs of the Driving Licence Commission of the German Society of Epileptology, we thank Martin Holtkamp and his co-authors for their article in the last issue of this journal [14]. They report on a 62-year-old lorry driver with a first acute symptomatic seizure three weeks after neurosurgical excision (due to an unconfirmed suspicion of cavernoma) of a phenprocoumon-induced left frontal near-cortex cerebral haemorrhage in atrial fibrillation, who had been treated with levetiracetam for six months. Assuming freedom from seizures after discontinuation of levetiracetam, they propose a necessary seizure-free period of six months for group 1 driving licences and of two years for group 2 driving licences (without medication) to regain fitness to drive. They correctly point out that in the present German assessment guidelines for fitness to drive, which are currently being revised [6] and in the formulation of which we were and are both involved, acute symptomatic (formerly: provoked) seizures as a result of an acute structural brain lesion are not (yet) taken into account.

On the development of the current assessment guidelines

In order to understand the current driving guidelines, it is important to know how they were developed and what their frame of reference is. The basis of the guidelines, which have been in force unchanged since 2009, was the report of a working group of the European Union in 2005, in which one of us (G.K.) participated. In this report, the data available at that time on the recurrence and accident risk of epileptic seizures were compared with accepted general accident risks in road traffic e.g. the accident risk at a blood alcohol level of 0.05%, in young men or in old drivers. It was the first systematic step towards evidence-based driving guidelines. As a result, the *absolute* seizure recurrence risk for the following year ("Chance of an Occurrence of a Seizure in the next Year", COSY) became the benchmark for assessment [17]; this approach has been increasingly accepted internationally. One vagueness of the report of the EU working group was that for Group 1 fitness to drive (e.g. private cars), instead of a concrete figure, a corridor of 20–40% was given for the COSY. In this respect, the current German Driving License Commission, in line with the approach in Great Britain [4], has set a 20% limit for COSY as appropriate. For Group 2 fitness to drive, the EU working group report considered a COSY of 2% as a fixed limit [17], and under EU

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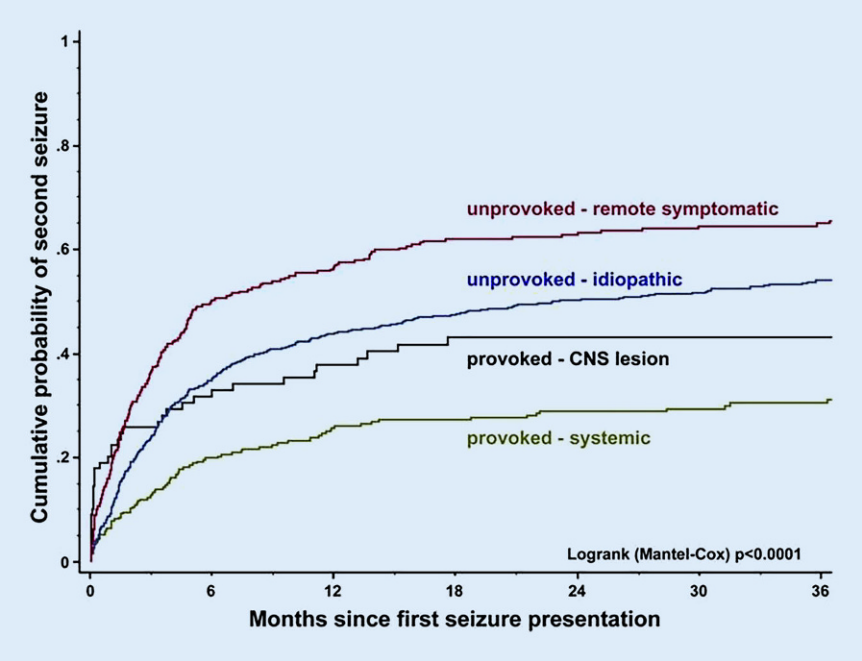

Fig. 1 ▲ Seizure recurrence after a first seizure in relation to aetiological groups (*unprovoked—remote symptomatic:* First unprovoked seizure with a history of or neuroimaging evidence for a prior CNS insult (including brain tumors), *unprovoked—idiopathic:* First unprovoked seizure with no obvious cause, *provoked—CNS lesion:* First provoked (acute symptomatic) seizure within 7 days of a central nervous system (CNS) insult (e.g., head injury, stroke or CNS infection), or with an acute systemic insult and an epileptogenic lesion on CT or MRI, *provoked—systemic:* First provoked (acute symptomatic) seizure related to an acute systemic, metabolic or toxic insult (including alcohol and drug withdrawal) *without an* epileptogenic lesion on neuroimaging). (Reprinted from [5] with permission of BMJ Publishing Group Ltd.)

law, member states are allowed to adopt stricter but not more liberal regulations.

The role of the EEG

Epileptiform potentials in the EEG have been shown to be the most important predictor of seizure recurrence in first unprovoked seizures, with a greater influence than a cerebral lesion [18]. EEG findings are not mentioned in the patient by Holtkamp et al. The data on the value of EEG in acute symptomatic seizures is insufficient and inconsistent. Some studies show a negative predictive significance of epileptiform potentials [2, 5, 8]. In the "SeLECT study" in patients with ischaemic insults, epileptiform potentials were not predictive [9]. This could be explained by the different aetiologies of the lesions.

Not all lesions have the same prognostic value

The difficulty in estimating the risk of recurrence in a patient with an acute symptomatic seizure in the context of an acute brain lesion lies in the great heterogeneity of clinical, pathophysiological and imaging constellations, e.g. with regard to the type, size and localization of a lesion. This is exemplified by the large "SeLECT study", which has worked out prognostic factors for late seizures after ischaemic insults. Although this involves only a single aetiology, the risk of a late seizure differs considerably: patients with an early seizure in the context of a clinically mild (NIHSS score ≤ 3) infarct outside the territory of the MCA and without further risk factors have only a 1-year seizure risk of 4% (95% confidence interval [CI]: 3–5%). If cortical infarct involvement, atherosclerosis of a large brain artery and localization in the MCA territory are added, the risk increases to 28% (CI 20–35%) [10].

Based on all available data, it can be assumed that the risk of seizure recurrence differs between aetiologically different lesions [11]. Therefore, data from ischaemic infarctions cannot be transferred to intracerebral haemorrhages. Here, the risk of seizure is determined, among other factors, by the volume of the haemorrhage [3, 13, 15]. According to the (methodologically not completely convincing) CAVE score on the outcome of patients with intracerebral haemorrhage, the patient of Holtkamp et al. would have a primary seizure risk of 34–46% depending on the volume of the haemorrhage [13]. If the data of this and other studies are extrapolated with regard to group 2 fitness to drive, the COSY is above the limit of 2% even after significantly longer than two years of observation, so that group 2 fitness to drive must be denied [11, 13, 16].

What is the standard for assessing fitness to drive?

Holtkamp et al. argue in terms of a *relative* risk assessment with a similar risk of seizure recurrence of patients with an acute symptomatic seizure in the context of a structural cerebral lesion on the one hand and patients with a first unprovoked seizure on the other hand and therefore consider a seizure-free minimum period of six months for driving license group 1 to be appropriate. This assessment seems to be confirmed by the data from the largest cohort with follow-up after a first seizure to date, the Western Australian First Seizure Database (◘ **Fig. 1**; [5]). However, this study also does not provide information on a lesion-specific risk of recurrence in intracerebral haemorrhage.

The international perspective

While the constellation of an acute-symptomatic seizure in the context of a structural lesion is not mentioned in the driving guidelines of Australia, as in the current German guidelines [1], the Canadian guidelines treat such a seizure identical to an established epilepsy, for which a seizure-free period of at least 6 months is required in Canada [7]. In the UK, the identical 6-month period applies

to acute symptomatic seizures with and without a lesion [12].

Our conclusion

- For a reliable evidence-based assessment of fitness to drive, further lesion-specific data on seizure recurrence risk would be desirable. In particular, data for intracerebral haemorrhages are limited. Drawing an analogy to first unprovoked seizures does not do take into account to the heterogeneity of lesional constellations, and there is sufficient evidence that intracerebral haemorrhages are associated with an increased risk of recurrence compared to ischaemias. In this respect, a seizure-free period of nine months (after discontinuation of the anti-seizure medication) could be appropriate for group 1 driving eligibility in the case described by Holtkamp et al.
- For group 2, the patient is not allowed to drive due to the existing assessment guidelines after a brain haemorrhage (chapter 3.9.4, "Circulatory disorders of brain activity"; [6]). If one considers the risk of seizure recurrence alone, this still lies clearly above the required 2% COSY after the two-year observation period proposed by Holtkamp et al. Furthermore, because of atrial fibrillation and the associated risk of syncope, an additional cardiological assessment is required.

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