



# Hepatic encephalopathy and traffic accidents: Vigilance is needed!

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## Driving while cirrhotic: What's at stake

Minimal, covert, low-grade, or subclinical hepatic encephalopathy (HE) are labels that fail to capture the true clinical and social significance of this entity. Beyond liver outcomes, HE impairs quality of life, promotes falls and increases the risk of daily accidents at home, in the workplace, or when driving a car.<sup>1–4</sup> However, HE is underappreciated as a risk factor for traffic accidents, especially in the context of other diseases such as seizures, diabetes and dementia.<sup>5,6</sup> Patients and medical providers could be potentially liable if a motor vehicle collision occurs due to HE when unexplored and unregulated and could lead to changes in laws.<sup>7</sup> Recent surveys, however, from United States, Canada, Spain, and United Kingdom highlighted that criteria to define unfit drivers vary among countries and even between particular states without clear guidelines for the assessment of fitness to drive or the reporting of patients with HE.<sup>5,6</sup> Mitigation of these risks requires a wider perspective. This includes changes in public policy (including laws and regulatory actions from appropriate legal authorities about comorbidities associated with increased risk of traffic accidents) to education at multiple levels, organisational (including actions focused on patient organisations and social institutions), interpersonal (involving relatives, friends, and social networks) and individual (focused on improvement of skills, knowledge and attitudes of the patient to determine limitations when driving). Clinicians treating patients with cirrhosis play a central role in this plan beginning with the identification of risk factors. In the current issue of *Journal of Hepatology*, psychomotor vigilance task (PVT) appears useful in the detection of both conditions (unfitness to drive and HE) (see Fig. 1).

## The impact of HE on driving: What the data says (and what it does not)

The fatigue and cognitive deficits that define covert HE, namely impaired attention, poor response inhibition, and delayed information processing, are highly consequential for driving performance. Indeed, covert HE is associated with both car crashes

and suboptimal driving simulator performance.<sup>1,4</sup> Lauridsen *et al.* compared driving performance with official driving records. Patients with minimal HE by psychometric testing were more likely to be unsafe drivers (16%) than those with normal cognition (7%) and illegal turns in a simulator task were associated with actual car crashes.<sup>8</sup> Two studies have employed on-road driving tests, demonstrating that individuals with minimal HE overestimate their driving abilities, which are limited particularly with respect to passing, timely braking and steering wheel handling.<sup>9,10</sup>

Testing to stratify patients for their risk of car crashes would be valuable and potentially cost-effective.<sup>2</sup> Bajaj *et al.* demonstrated that the inhibitory control test is sensitive but not specific for future car crashes.<sup>1</sup> One study has shown efficacy for rifaximin therapy in the improvement of driving simulator performance.<sup>3</sup> However, Kircheis *et al.* found that for patients with HE the concordance between computerised psychometric testing and driving instructor assessments was no greater than 64%.<sup>10</sup> We therefore lack an efficient and accurate modality to assess fitness to drive among patients with cirrhosis at-risk of HE. This is not specific to HE, but rather a struggle seen in most chronic conditions that can impact driving.

## The current study's design

Seeking to bridge this gap, Formentin *et al.* enrolled 145 patients with cirrhosis (56% of whom had prior overt HE and 71% were on medical therapy for HE) who performed the PVT, all of whom were followed for an average of 13 ± 5 months and 117 of whom completed a questionnaire regarding their driving. The PVT is a test of the ability to maintain attention and is a widely used measure of vigilance and fitness to drive among patients with sleep disorders. It is a 10-minute assessment administered using a hand-held device. The PVT test-taker is asked to press a button in response to numerical stimuli and is evaluated in terms on the proportion of correct responses and their mean reaction time.

## Study findings

First, while the PVT had not been previously tested in patients with HE, among the 106 patients who competed

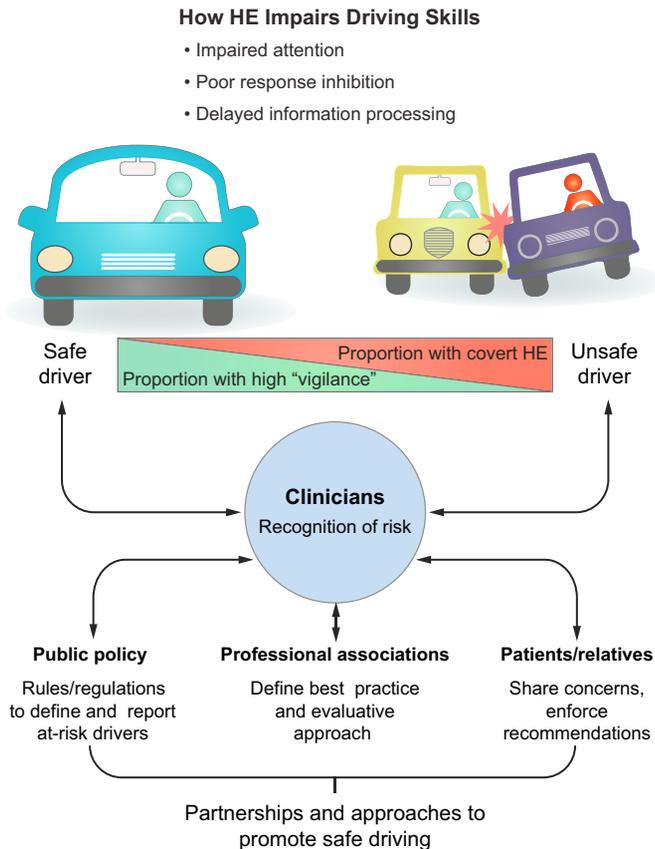
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**Fig. 1.** Cirrhosis is an important risk factor for unsafe driving. Although while patients with prior overt hepatic encephalopathy (HE) are known to be at markedly increased risk, there are substantial gaps in how to identify at-risk persons prior to overt episodes as well as in the guidance for how to discuss and enforce actions to mitigate that risk. The study by Formentin *et al.* highlights how selected patients on the basis of cognitive performance (using psychometric or computerised tests of cognitive function) can be identified as at-risk for poor driving performance.

neuropsychometric testing, the authors found consistent correlations between PVT performance and both psychometric HE scores and electroencephalography. Second, though driving performance was not assessed, the authors find that PVT performance was poorest among those who were not driving. Third, and most importantly, the authors found that PVT reaction times were associated with age- and model for end-stage liver disease-adjusted risk of HE-related hospitalisation and death at 6 and 12 months. The authors' findings are strengthened by their relatively large sample size and the prediction of clinical events. However, as a test of driving fitness, additional research and external, prospective validation are needed. This is because most of the patients enrolled were actively treated for HE, most patients with HE were already not driving based on clinical criteria independent of PVT or minimal HE (MHE), and the authors did not exclude sleep apnoea, which can directly affect both driving and PVT performance. PVT changes were also not predictive of driving events in patients with or without MHE. Further, adverse outcome prediction using PVT indices is very promising but may not supersede a simple history of overt HE (yes/no) or other established measures of MHE, including those employed in this study

## Conclusions/future directions

Driving requires an intricate coordination of neuro-cognitive domains with rapid responses to the vehicle within a changing environment. These faculties can be impacted by chronic diseases and especially alterations throughout the spectrum of HE. As the population ages and the prevalence of cirrhosis skyrockets, there is an important need to develop strategies that could stratify patients at high risk of driving impairment beyond current clinical practice.<sup>11</sup> While an ideal test would be a rapid point-of-care option that can exclude the majority of unsafe drivers, such a test is unlikely to appear given the relative rarity of traffic offenses. These have not been effective in gauging driving fitness in patients suspected of mild cognitive impairment and dementia, both much more prevalent conditions compared to HE or MHE.<sup>12</sup> Furthermore, regardless of strategies that evaluate driving fitness, there is uncertainty around how to apply these results into practice.<sup>13</sup> The role of clinicians is a balancing act between the interests of patients compared to society while upholding the law, which often makes the topic uncomfortable to broach and liable to be ignored.<sup>14</sup> The future lies in improving the comfort of patients, families and clinicians to recognise that driving history is an essential aspect of the holistic approach towards cirrhosis care. Until we as clinicians make driving issues a routine part of our patient evaluation, it is unlikely that any test or combinations thereof that assess driving would make a major difference in the daily function of our patients and their families.

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## Conflict of interest

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Please refer to the accompanying [ICMJE disclosure](#) forms for further details.

## Authors' contributions

Concept: Bajaj, Romero-Gomez, Tapper. Writing: Bajaj, Romero-Gomez, Tapper

## Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jhep.2019.01.017>.

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