

# 'Just take a CT scan!'

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## LEDER

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Clinical diagnosis of mild head injuries is difficult, and it is easy to resort to a CT scan for clarification. Biomarkers are set to play an important role.

In 2013, the Scandinavian Neurotrauma Committee (SNC) published guidelines for the management of adults with minimal, mild and moderate head injuries (1). Here, a serum measurement of the brain injury marker S100B was included for the first time as an alternative to a CT scan for patients with a mild head injury and a low risk of developing an intracranial haematoma. Up to half of patients are in this category (2-4).

Akre and Ingebrigtsen present in the Journal of the Norwegian Medical Association a retrospective study on compliance with the guidelines at the University Hospital of North Norway (2). They included 150 patients who were discharged with a head injury diagnosis over a one-year period. About two-thirds of the patients were treated as recommended. S100B analysis was performed on 50 patients, including 35 of 57 with a low-risk mild head injury. Of these 35, the results were negative for 15, and 14 of these did not undergo a CT scan. Using S100B analyses therefore spared 25 % of the patients from having a CT scan.

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From the same hospital, Fosse and Ølness write about the use of S100B analyses over a one-year period (5). They observe that about 50 % of the samples were taken on the wrong indication, including from children, and that over 40 % of adults with a negative test result still underwent a CT scan. Where S100B was analysed on the correct indication, however, it was significant for the further treatment in the majority of patients.

A prospective study at Akershus University Hospital described similar challenges (3). Here, 63 % of the patients were managed according to the guidelines. S100B analysis was performed on 188 of 223 patients with a low-risk mild head injury, and the result was negative for 37 % of these. Despite this, almost half underwent a CT scan.

There are many explanations for non-compliance with guidelines, and it must also be possible to deviate from them on the basis of a documented discretionary judgement. The S100B analysis has its weaknesses, such as false positive values, and it can take up to two hours to get the result. This creates challenges for the patient flow in acute admissions departments and when there is a need for rapid diagnostic clarification. The mantra 'Just

take a CT scan' therefore often trumps arguments about radiation risk and costs. Many doctors choose not to use the S100B for this very reason. For example, the analysis is not available at the Accident and Emergency department in Oslo, where approximately 4000 CT scans are taken of head injuries every year (4). It may be appropriate to reflect on the fact that the recommended use of S100B has been shown to be better than D-dimer for pulmonary embolism and troponin-T for myocardial infarction (6). However, S100B cannot be used without indication to decide whether a CT scan should be taken or not; this only serves to undermine confidence in the analysis.

New biomarkers and more accessible analysis platforms would almost certainly give a real boost to the field

The S100B is, in all probability, only the first step on the road to better diagnosis of head injuries. A recently published study from the Center-TBI network examined a panel of six biomarkers, including S100B, from nearly 3000 patients with head injuries (7). All of the biomarkers reflected clinical severity, treatment needs and CT findings. Glial fibrillary acidic protein (GFAP) stood out as the best biomarker. This marker was also better than S100B in a recent study by the TRACK-TBI network (8). The most interesting aspect, however, was that a hand-held prototype of a patient-centred analysis platform of glial fibrillary acid protein was used, which gave a result within 15 minutes. The platform is based on plasma analysis and is currently at the approval stage in the United States. In parallel with this, work is underway on an even more practical analysis of this protein in whole blood.

There is a strong case for biomarkers playing a more central role in the diagnosis of head injuries. We still have some way to go to improve guidelines and implementation, but new biomarkers and more accessible analysis platforms would almost certainly give a real boost to the field. It will hopefully be easier to make wise choices in the future (9).

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#### REFERENCES:

1. Sundstrøm T, Wester K, Enger M et al. Skandinaviske retningslinjer for akutt håndtering av voksne pasienter med minimal, lett eller moderat hodeskade. Tidsskr Nor Legeforen 2013; 133: E1–6. [PubMed][CrossRef]
2. Akre KAT, Ingebrigtsen T. Blir retningslinjer for behandling av mindre alvorlige hodeskader fulgt? Tidsskr Nor Legeforen 2021; 141. doi: 10.4045/tidsskr.20.0986. [CrossRef]
3. Ananthaharan A, Kravdal G, Straume-Naesheim TM. Utility and effectiveness of the Scandinavian guidelines to exclude computerized tomography scanning in mild traumatic brain injury - a prospective cohort study. BMC Emerg Med 2018; 18: 44. [PubMed][CrossRef]
4. Naqvi A. Head CT after minimal, mild and moderate traumatic brain injury; audit of clinical practice. Masteroppgave. Oslo: Oslo Metropolitan University, 2020. <https://oda.oslomet.no/handle/10642/8964> Accessed 12.4.2021.
5. Fosse GØ, Ølness IO. Bruk av S100B ved akutte hodeskader. Tidsskr Nor Legeforen 2021; 141. doi: 10.4045/tidsskr.21.0157. [CrossRef]
6. Thelin EP, Nelson DW, Bellander BM. A review of the clinical utility of serum S100B protein levels in the assessment of traumatic brain injury. Acta Neurochir (Wien) 2017; 159: 209–25. [PubMed][CrossRef]
7. Czeiter E, Amrein K, Gravesteyn BY et al. Blood biomarkers on admission in acute traumatic brain injury: Relations to severity, CT findings and care path in the CENTER-TBI study. EBioMedicine 2020; 56: 102785. [PubMed][CrossRef]
8. Okonkwo DO, Puffer RC, Puccio AM et al. Point-of-care platform blood biomarker testing of glial fibrillary acidic protein versus s100 calcium-binding protein b for prediction of traumatic brain injuries: a transforming research and clinical knowledge in traumatic brain injury study. J Neurotrauma 2020; 37: 2460–7. [PubMed][CrossRef]
9. Den norske legeforening. Gjør kloke valg – radiologi. <https://www.legeforeningen.no/foreningsledd/fagmed/norsk-radiologisk-forening/artikler/fag-og-utd>

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