Persistent post-concussion symptoms after mild traumatic brain injury (mTBI): Early predictors and early intervention

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Theme
Persistent post-concussion symptoms occur in up to 15% of individuals after mTBI, and some patients suffer from long-term sequelae that reduce both quality of life and work ability. In recent years, research has focused on the identification of early predictors for poor outcome, and on the development of early interventions for those at risk.

This symposium will present data from EPIC, a Danish interdisciplinary population-based study investigating the epidemiology, pathophysiology, and effect of early intervention in concussion. After a cohort description of EPIC, the second and third talk will discuss potential predictors of favorable illness courses: attachment style on the one hand, and increasing micro-structural integrity in the corpus callosum observed with MRI on the other. Finally, the last speaker will present data from a recent randomised trial that compared the ability of an early interdisciplinary intervention (GAIN) to reduce impairing post-concussion symptoms with that of enhanced usual care.

Takeaways
1. How are persistent post-concussions conceptualized, and which information should be provided to patients in the early stages? 2. What is the relative contribution of biological and psychological factors on symptom persistence? 3. How can long-term symptoms be managed in a way that both acknowledge patients’ worry and reduced function, but on the other hand raise hope for full restitution and provide strategies to achieve this aim?

Chair: Andreas Schröder, Clinical associate professor, Consultant Aarhus University Hospital, DK
Epidemiology, pathophysiology, and effect of early intervention in concussion: Cohort description of the Danish EPIC study

Aim
Concussion is an important public health concern. According to the WHO Task Force, the incidence of hospital-treated concussion or mTBI is 100 to 300/100,000. Up to 15% of patients continue to experience longlasting and debilitating symptoms. However, the complex mechanisms, suggested to involve both biological and psychosocial factors, behind the transition from subacute to persistent post-concussion symptoms are poorly understood. The aim of the Danish EPIC study is to investigate the epidemiology, pathophysiology and effect of early intervention on concussion.

Methods
The Danish EPIC study is a comprehensive study that combines a classical epidemiological approach with a pragmatic randomised controlled trial design and basic research. The research team is multidisciplinary and brings together neurologists, psychiatrists, neuropsychologists, physiotherapists, occupational therapists, epidemiologists, and specialists in neuroimaging.

Results
The presentation gives a short description of the overall study design, including who is the sample, how long have they been followed, what is attrition like and what is being measured. Also, there will be an overview of the embedded substudies.

Conclusion
The Danish EPIC study will provide largescale reliable and valid long-term longitudinal data on concussion. This can enable good quality research on both aetiology and natural course of persistent post-concussion symptoms. Moreover, long-term outcome of early intervention for concussion-related health problems can be interpreted on the background of rich data on the natural recovery process. This is important if we are to move forward in this still quite neglected area, both scientifically and from the point of view of prevention and public health policy.

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Attachment style and symptom reporting in young persons with concussion

Aim
5-15 % of people with concussion experience post-concussion symptoms (PCS) more than 3 months post-injury. The etiology of PCS is complex, with interacting biological, psychological, and environmental factors. Attachment styles (AS) is grounded in childhood and activated when one is exposed to stressful situations in order to feel secure. AS may be important to understand how interpersonal processes affect the development of PCS and illness responses. The aim of this study was to explore the associations between AS, illness perception, illness behavior and symptom reporting in young persons with a recent concussion.

Methods
The project is embedded in the Danish EPIC study including 3080 15-30 year old individuals diagnosed with concussion. 3 months post-injury they all received questionnaires on: general health, PCS (Rivermead Post-Concussion Symptoms Questionnaire (RPQ)), AS (measured as anxiety and avoidance dimensions on the Experiences in Close Relationships-Relationship Structure(ECR-RS)questionnaire), illness perception (Brief-Illness Perception Questionnaire (B-IPQ)) and illness behavior (Behavioural Responses to Illness Questionnaire (BRIQ)).

Results
1101 patients responded. Using linear regression models, the ECR-RS anxiety score was positively associated with the PCS score: 2.1(95%CI 1.6; 2.6), p<0.001, whereas the ECR-RS avoidance score was negatively associated with the PCS score: -3.3 (95%CI -4.3; -2.3), p<0.001. Structural equation model analyses showed significant associations between ECR-RS dimensions and B-IPQ, BRIQ and RPQ scores. Detailed results will be presented.

Conclusion
Knowledge about the role of various attachment styles for the development of persisting PCS may contribute to the understanding of why young persons with concussion have very different illness courses.

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Traumatic brain injury and its effect on mental and physical health of close relatives: The role of posttraumatic stress symptoms

Aim
Traumatic brain injury (TBI) instigates widespread disability and extensive rehabilitation. Consequently, TBI often conveys malignant consequences to the patients’ close relatives, which are often explained by injury severity and the burden it causes. Recent findings demonstrate that patients with TBI and their relatives may develop posttraumatic-stress (PTS) symptoms. However, although the link between PTS symptoms and physical and mental health is well-documented, the effects of PTS symptoms on relatives of patients with TBI has barely been examined. The aim of this study is to examine the effects of patients’ and relatives’ PTS symptoms following TBI on the relatives’ physical and mental health and functioning.

Methods
Patients who sustained a severe TBI (Abbreviated Injury Scale of the head region > 3) and close relatives were included in a multi-center, prospective cohort study (Trajectories of Recovery After Severe Traumatic Brain Injury – Matters In families; TRASTMI). One-hundred patients and their relatives were assessed at 2, 6, and 12 months postinjury. Outcome variables included relatives’ health related quality of life (SF-12 Health Survey), emotional, cognitive, interpersonal and total functioning (Relative Version of the Patient Competency Rating Scale; PCRS).

Results
Relatives’ physical health was associated with relatives’ PTS symptoms (Slope=-1.76; p=.043), and mental health was associated with both patients’ (Slope=-2.77; p=.034) and relatives’ (Slope=-6.59; p<.001) PTS symptoms. Functioning level was only associated with patients’ PTS symptoms (Slope=-.25; p<.001).

Conclusion
The findings emphasize that TBI should be considered a comprehensive traumatic experience reaching further than mere physical damage to the brain and its direct consequences, affecting the injured individual and close relatives.

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Early intervention for impairing post-concussion symptoms in adolescents and young adults: results from a randomised trial

Aim
Up to 15% experience persistent symptoms after a concussion. There is a high need for effective interventions to prevent long-term consequences, but evidence is sparse. The aim of this study was to test the efficacy of Get going After concusion (GAIN), a newly developed, early intervention for young patients (15-30 years) with persistent postconcussion symptoms (PCS) 2-6 months post-injury.

Methods
Participants (n=112) were randomly assigned (1:1) to either Enhanced Usual Care (EUC), i.e. clinical evaluation, education and advice, or GAIN, i.e. 8 weeks of individually tailored, interdisciplinary intervention focusing on symptom-perpetuating illness perceptions and illness behaviours. Patients completed self-report measures at inclusion (baseline), end of intervention and at 3-month follow-up (FU). The primary outcome measure was the Rivermead Post-concussion symptoms Questionnaire (RPQ) at 3-month FU. All analyses were done on an intention-to-treat basis.

Results
Patients allocated to GAIN (n=57) reported a significantly larger reduction of PCS compared to patients allocated to EUC (n=55) with a mean difference in improvement from baseline to 3-month FU of 7.5 points (95% confidence interval (CI) 2.0-13.1 , p=0.008). Number needed to treat for prevention of one additional case of persistent PCS at 3-month FU was 3.7 (95% CI 2.2 ; 11.3). Patient satisfaction was high. No adverse events were observed during treatment.

Conclusion
GAIN was safe and associated with high patient satisfaction. Compared with EUC, GAIN was associated with larger symptom reduction during and after treatment, and with a markedly reduced risk of having persistent PCS at 3-month FU (11 months post-injury).

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Diffusion kurtosis imaging in patients with prolonged post-concussion symptoms

Aim
The cause of prolonged post-concussion symptoms (PCS) is uncertain, but explanations suggesting multiple origins have been proposed. Diffusion kurtosis imaging (DKI) with measures as e.g. mean kurtosis tensor (MKT) may serve as a sensitive technique to detect microstructural changes in the brain after concussion. We examined MKT changes in corpus callosum, thalamus and hippocampus, and change in PCS severity as measured with the Rivermead Post-concussion Questionnaire 6 months after inclusion in an RCT.

Methods
Forty-two patients age 23.3 (sd±3.6) with prolonged PCS were recruited from an RCT with patients undergoing either multidisciplinary behavioral intervention (GAIN, n=23) or enhanced usual care (EUC, n= 19). Patients were scanned on average 135.2 days (sd±37.8) after injury and again 6 months later.

Results
The GAIN group showed a significant increase of MKT in corpus callosum of 0.01 (CI[0.004;0.021], p= 0.007) and a significant decrease in hippocampus of -0.007 (CI[0.0132;0.0004], p= 0.04). In comparison there was a significant mean difference of 0.019 (CI[0.007;0.031], p=0.003) of MKT in corpus callosum between the two groups. The GAIN group showed a significant reduction in PCS of -8.33 (CI[-4.34;-12.33], p=0.0003). Compared to the EUC group there was a significant mean difference of 6.53 (CI[0.93;12.13], p=0.02) in favor of GAIN. There were no significant correlations between MKT and PCS.

Conclusion
MKT in corpus callosum was significantly increased indicating increased microstructural integrity in patients receiving GAIN compared to EUC after 6 months. Moreover, PCS was significantly decreased in favor of GAIN but there was no significant association between MKT and PCS.

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