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Prognostic accuracy of head computed tomography for prediction of functional outcome after out-of-hospital cardiac arrest -Rationale and design of the prospective TTM2-CT-substudy

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Background: Head computed tomography (CT) is a guideline recommended method to predict functional outcome after cardiac arrest (CA), but standardized criteria for evaluation are lacking. To date, no prospective trial has systematically validated methods for diagnosing hypoxic-ischaemic encephalopathy (HIE) on CT after CA. We present a protocol for validation of pre-specified radiological criteria for assessment of HIE on CT for neuroprognostication after CA.

Methods: This is a prospective observational international multicentre substudy of the Targeted Hypothermia versus Targeted Normothermia after out-of-hospital cardiac arrest (TTM2) trial. Patients still unconscious 48 hours post-arrest at 13 participating hospitals were routinely examined with CT. Original images will be evaluated by examiners blinded to clinical data using a standardized protocol. Qualitative assessment will include evaluation of absence/presence of “severe HIE”. Radiodensities will be quantified in pre-specified regions of interest for calculation of grey-white matter ratios (GWR) at the basal ganglia level. Functional outcome will be dichotomized into good (modified Rankin Scale 0-3) and poor (modified Rankin Scale 4-6) at six months post-arrest. Prognostic accuracies for good and poor outcome will be presented as sensitivities and specificities with 95% confidence intervals (using pre-specified cut-offs for quantitative analysis), descriptive statistics (Area

Fig. 1. SOP checklist for qualitative analysis

Patient: _____ Rater: _____

Prerequisites
Levels

Artifacts precluding analysis	yes	no
Brain diseases precluding analysis	yes	no
Residual contrast agent visible	yes	no

Qualitative Analysis

Start using standard brain window and then adapt to optimize visibility of grey-white matter differentiation. *Evaluate axial images at these 4 different levels. Consider the best grey-white-differentiation, best visibility of sulci*

1 - Brain stem + Cerebellum		
Effacement of CSF spaces	yes	no
Pseudo-SAH	yes	no
White Cerebellum Sign	yes	no
2 - Basal ganglia		
Bilateral loss of grey-white distinction	yes	no
Bilateral sulcal effacement	yes	no
Reversal sign	yes	no
3 - Frontoparietal cortex corona radiata level		
Bilateral loss of grey-white distinction	yes	no
Bilateral sulcal effacement	yes	no
4 - High convexity cortex		
Bilateral loss of grey-white distinction	yes	no
Bilateral sulcal effacement	yes	no

Considering all 4 levels

Complete loss of grey-white distinction	yes	no
Complete effacement of all sulci	yes	no

Result of qualitative analysis

Definite severe HIE: *complete or near complete loss of grey-white distinction in the basal ganglia and in the frontoparietal cortex with additional evidence of brain swelling/sulcal effacement. Consider patient age while evaluating.*

Definite signs of severe HIE
No definite signs of severe HIE