Published in final edited form as:

Resuscitation. 2015 July ; 92: A1. doi:10.1016/j.resuscitation.2015.04.029.

Blurred lines: Reduced discrimination of gray white junctions observed on CT in out-of-hospital cardiac arrest (OHCA) portends poor prognosis

Holly E. Hinson

Neurocritical Care, Neurology, and Emergency Medicine, Oregon Health & Science University, Portland, United States

Holly E. Hinson: hinson@ohsu.edu

Therapeutic hypothermia (TH) is a powerful tool that improves neurologic outcomes in a subset of patients suffering out of hospital cardiac arrest (OHCA). However, TH may delay the ability to perform a clinical neurologic exam and other tests, like EEG, that allow prognostication in comatose survivors of OHCA.¹ In contrast, neuroimaging may be better suited to early prognostication during TH.² In this issue of *Resuscitation*, Langkjær and colleagues analyzing acute Head Computed Tomography (CT) scans when available in a large cohort of OHCA survivors ($n = 341$).³ “Reduced discrimination” between gray and white matter and/or cerebral edema predicted a significantly greater 30 day mortality. This association held true for patients receiving scans early (<24 h from arrest), and for those receiving scans later (≥ 24 h, a median of 3 [IQR 2–5] days).³ The majority (70%), but not all, patients underwent TH.

This is the largest study to date addressing the question of CT after cardiac arrest. The results agree with previous investigations. In a large cohort of cardiac arrest patients ($n = 240$), decreased gray matter attenuation to white matter attenuation ratio (GWR) on CT within 24 h of arrest, was associated with poorer survival.⁴ Subjects with severe cerebral edema, defined by $GWR < 1.20$, had very low survival with conventional care, including hypothermia. This association of GWR with outcome held true when the CT was performed within an hour of arrest in patients that were being treated with TH, Kim et al. found a threshold of an average $GWR < 1.14$ predicted a poor neurological outcome with a high specificity and high positive predictive value.⁵ If return of spontaneous circulation (ROSC) is regained quickly (within 20 min), patients had fewer signs of ischemia (loss of gray-white boarder) on CTs obtained within an hour of resuscitation and better outcomes.⁶ As such, the European Society of Intensive Care medicine recommends “using the presence of a marked reduction of the GM/WM ratio or sulcal effacement on brain CT within 24 h after ROSC to predict a poor outcome in patients who are comatose after resuscitation from cardiac arrest both TH-treated or non-TH-treated.”⁷

The Langkjær study has some important limitations. The authors did not measure GWR in their cohort, which would have allowed an objective measure facilitating comparison with previous studies. There was not a standard protocol regarding which patients received scans and when those patients were scanned, potentially introducing a selection bias. CTs were obtained in younger patients with fewer co-morbidities, and these patients were more likely to undergo hypothermia. ICU physicians were not blinded to the results of the CTs, potentially introducing a self-fulfilling prophecy,⁸ namely that families of patients with reduced discrimination might be counseled to withdraw care. Unfortunately, we do not know the role the CT played in withdrawal of support decisions.

Despite the widespread availability and ease of obtaining head CTs, questions remain on the optimal timing with regard to prognosis. Is it necessary to calculate a GWR, or is merely detecting “reduced discrimination” enough as this paper suggests? The answers to these important questions await prospective studies using a standardized head CT protocol in comatose survivors of OHCA with or without TH.

References

1. Blondin NA, Greer DM. Neurologic prognosis in cardiac arrest patients treated with therapeutic hypothermia. *Neurologist*. 2011; 17:241–8. [PubMed: 21881465]
2. Hahn DK, Geocadin RG, Greer DM. Quality of evidence in studies evaluating neuroimaging for neurologic prognostication in adult patients resuscitated from cardiac arrest. *Resuscitation*. 2014; 85:165–72. [PubMed: 24231568]
3. Langkjær, S.; Hassager, C.; Kjaergaard, J., et al. Prognostic value of reduced discrimination and oedema on cerebral computed tomography in a daily clinical cohort of out-of-hospital cardiac arrest patients. *Resuscitation*. 2015. <http://dx.doi.org/10.1016/j.resuscitation.2015.03.023>
4. Metter RB, Rittenberger JC, Guyette FX, Callaway CW. Association between a quantitative CT scan measure of brain edema and outcome after cardiac arrest. *Resuscitation*. 2011; 82:1180–5. [PubMed: 21592642]
5. Kim SH, Choi SP, Park KN, Youn CS, Oh SH, Choi SM. Early brain computed tomography findings are associated with outcome in patients treated with therapeutic hypothermia after out-of-hospital cardiac arrest. *Scand J Trauma Resusc Emerg Med*. 2013; 21:57. [PubMed: 23870424]
6. Inamasu J, Miyatake S, Suzuki M, et al. Early CT signs in out-of-hospital cardiac arrest survivors: temporal profile and prognostic significance. *Resuscitation*. 2010; 81:534–8. [PubMed: 20189285]
7. Sandroni C, Cariou A, Cavallaro F, et al. Prognostication in comatose survivors of cardiac arrest: an advisory statement from the European Resuscitation Council and the European Society of Intensive Care Medicine. *Resuscitation*. 2014; 85:1779–89. [PubMed: 25438253]
8. Wilkinson D. The self-fulfilling prophecy in intensive care. *Theor Med Bioeth*. 2009; 30:401–10. [PubMed: 19943193]