

# Does the Primary Imaging Modality—Computed Tomography or Magnetic Resonance Imaging—Influence Stroke Physicians' Certainty on Whether or Not to Give Thrombolysis to Randomized Acute Stroke Patients?

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*Background:* Door-to-needle time of 20 minutes to stroke patients with intravenous tissue plasminogen activator (iv-tPA) is feasible when computed tomography (CT) is used as first-line of brain imaging. Magnetic resonance imaging (MRI)-based assessment is more time-consuming but superior in detecting acute ischemia. The certainty with which stroke physicians prescribe or refrain from giving iv-tPA treatment to CT- versus MRI-examined patients has not previously been studied. The aim of the present study was to determine the effect of a primary imaging strategy of CT or MRI on clinicians' certainty to prescribe or refrain from giving iv-tPA to patients with suspected acute stroke. *Method:* Consecutive patients with suspected stroke were quasi-randomized to either CT- or MRI-based assessment before potential iv-tPA treatment. The influence of (1) the clinical findings and (2) the image findings, and (3) the certainty with which the stroke physician prescribed or refrained from giving iv-tPA treatment were assessed with visual analog scales (VAS). Predictors of treatment certainty were identified with a random-effect model. *Results:* Four-hundred forty-four consecutive patients were quasi-randomized. MRI influenced the final treatment decision more than CT ( $P = .002$ ). Compared with CT-examined patients (mean VAS score 8.6, SD  $\pm 1.6$ ) stroke physicians were significantly more certain when prescribing or refraining from giving iv-tPA to MRI-examined patients (mean VAS score 9.0, SD  $\pm 1.2$ ) ( $P = .014$ ). No differences in modified Rankin scale or mortality were detected at 3 months in CT- versus MRI-examined iv-tPA-treated patients. *Conclusions:* Stroke physicians were significantly more certain when prescribing iv-tPA to MRI-examined stroke patients, and MRI influences the final treatment decision significantly more compared with CT, although no difference in mortality and functional outcome at 3 months

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Received March 10, 2017; revision received October 26, 2017; accepted October 29, 2017.

The trial was fully funded by the Danish Tryk Foundation (Grant No. 102175).

Author contribution: C.K.H., A.C., H.R., I.H., C.K., and H.C. were all involved in the study design. H.C. is the chief investigator, and C.K.H. managed the trial and conducted the statistical analysis. C.K.H., H.C., C.K., and H.R. drafted the manuscript. All authors have thoroughly reviewed the manuscript and have given final approval to this version.

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1052-3057/\$ - see front matter

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<https://doi.org/10.1016/j.jstrokecerebrovasdis.2017.10.035>

was detected between CT- and MRI-examined patients treated with iv-tPA. **Key Words:** Stroke—computed tomography—magnetic resonance imaging—thrombolysis—treatment decision—treatment certainty.

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## Introduction

Stroke teams have worked assiduously to reduce door-to-needle time (DNT) from hospital admission to administration of intravenous thrombolysis (iv-tPA) for acute stroke patients<sup>1-8</sup> as the treatment efficacy is time dependent, hence the saying “time is brain.”<sup>9</sup>

Compared with computed tomography (CT), magnetic resonance imaging (MRI) is more likely to show early signs of acute cerebral ischemia<sup>10,11</sup> but is more time-consuming and unfeasible in patients with ferromagnetic implants, pacemakers, claustrophobia, physical unrest, and large body size.<sup>12</sup> As the efficacy of iv-tPA is time dependent,<sup>13</sup> MRI must impart clinical benefits to justify its use as a primary imaging modality before iv-tPA administration.

As MRI-based assessment is superior in confirming early signs of ischemia and identifying some stroke mimics, it could add clinical information especially in situations with diagnostic uncertainty. If MRI were to be used as first-line imaging before iv-tPA administration, then one could speculate that stroke physicians would feel more certain about their decision to prescribe iv-tPA to acute stroke patients.

Although physicians' clinical decisions making have been studied,<sup>14-19</sup> studies on factors that influence stroke physicians' decision on whether or not to give iv-tPA treatment are scarce.<sup>20</sup> The certainty with which they prescribe or refrain from iv-tPA treatment has not previously been studied in a clinical setting.

We conducted a randomized clinical trial to answer the following question: Is CT or MRI head scan the best radiological imaging modality to use before intravenous thrombolysis for acute stroke patients? Image feasibility and DNT for CT- and MRI-based iv-tPA treatment have been reported<sup>12</sup>; the median DNT for MRI-examined patients was 11 minutes longer than for CT-examined patients and 42.0% of the MRI-allocated patients were not eligible for MRI because of contraindications or unstable medical conditions.

The aims of this substudy were to assess the certainty with which stroke physicians prescribed or refrained from giving iv-tPA treatment to acute stroke patients randomized to CT- or MRI-based assessment and to evaluate the influence of the clinical and radiological information available on the iv-tPA decision.

## Method

### Setting

All patients from the Region of Copenhagen (1.7 million inhabitants) presenting with symptoms of acute stroke within 4.5 hours from symptom onset were brought to Bispebjerg-Frederiksberg-Hospital on even dates after prenotification by the emergency service. Patients were treated with iv-tPA and endovascular treatment if eligible. The patients were brought directly to a dedicated stroke room within the Department of Radiology, bypassing the Emergency Department. Upon arrival, the patients were evaluated by a prenotified stroke team working according to a fast-track setup and composed of a stroke physician, a stroke nurse, a porter, a neuroradiologist, and 2 radiographers. The stroke physician was either a neurological resident in the final 6 months of training ( $n = 14$ , assessing 12.6% of the patients) or a neurological consultant ( $n = 4$ , assessing 12.8% of the patients) or a senior stroke neurological consultant ( $n = 6$ , assessing 74.5% of the patients).

The stroke physician initiated all examinations, informed the patients about iv-tPA-related benefits and risks, and advised the patients to accept the iv-tPA treatment if eligible. For patients who were able to provide consent, the final decision of accepting the treatment was their choice.

### Randomization

From December 2013 to November 2015, all consecutive patients (age >17 years) with suspected acute stroke and admission during daytime on weekdays (8:00 AM–3:00 PM) were quasi-randomized based on the day of admission to receive CT or MRI as the initial imaging strategy. An equal number of days were predefined as CT and MRI days and posted in the Department of Radiology at least 6 months in advance.

A radiological standard operational procedure was followed but allowed for crossover between the CT and MRI in case of predefined contraindications, absolute medical need of the nonallocated imaging modality, physical unrest, or patients in a critical condition not enabling MRI.

All MRI-allocated patients were systematically assessed for MRI eligibility.

Because of the clinical setup, blinding of patients and stroke team members was not possible.

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