Trends in the Effectiveness of Endovascular Recanalization for Acute Stroke: Is a Change Taking Place?

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Background: Despite recent technical advances in endovascular recanalization, there is skepticism regarding its clinical effectiveness compared with intravenous thrombolysis for treating acute ischemic stroke. We aimed to delineate its effectiveness and safety and their change over time. *Methods:* Using a prospective, multicenter stroke registry database, we identified 872 patients with ischemic stroke who underwent recanalization therapy with intravenous thrombolysis alone (IVT; n = 533) or endovascular recanalization with or without intravenous thrombolysis (EVT; n = 339) between April 2008 and January 2012. All subjects had National Institute of Health Stroke Scale score of 10 or more and arrived at the hospital within 4.5 hours of onset. Propensity score was used to address baseline imbalances between treatment groups, but balance adjustment was not performed for subgroup analyses. *Results:* The primary outcome was modified Rankin Scale score of 0-2 at discharge. The year-by-year effectiveness and safety of EVT and IVT were compared. Before 2010, the primary outcome was not associated with the recanalization method. However, in 2011,

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EVT increased the odds of having a primary outcome compared with IVT (adjusted odds ratio [OR], 1.87; 95% confidence interval [CI], 1.08-3.23). In 2011, EVT was superior to IVT regarding the achievement of a favorable outcome at 3 months after stroke (OR, 1.99; 95% CI, 1.10-3.59). The odds of in-hospital mortality and 3-month mortality were not different over 4 years. *Conclusions:* There might have been a change in the effectiveness of endovascular recanalization compared with intravenous thrombolysis, but the results remain tentative until prospectively evaluated. **Key Words:** Acute ischemic stroke—endovascular recanalization—comparative effectiveness research—propensity score—thrombolysis.

Two decades have passed since the efficacy of intravenous thrombolysis was proven in a randomized controlled trial and it became a standard treatment for acute ischemic stroke.[1,2] The recanalization rates after thrombolytic therapy, however, remained at approximately half of the cases.[3,4]

To achieve more complete and earlier recanalization, a combined intravenous and endovascular recanalization strategy has been recommended as an efficacious therapeutic approach[5,6] and has been applied widely.[7,8] Recent clinical trials have questioned this strategy with unexpected failures.[9-11] However, endovascular therapies for acute ischemic stroke have gained wide acceptance in clinical practice. Recanalization rates more than 70% with improvement of functional outcomes have been claimed.[12,13] In the United States, the use of endovascular strategies increased by 6-fold between 2004 and 2009.[14]

The discrepancy between real-world experiences and the results of clinical trials may be explained, in part, by the following considerations. First, newer devices, such as stent retrievers, have not been used in previous trials.[15,16] Second, the initiation of endovascular treatment has been delayed.[10] Such obstacles are inevitable to the conduction of clinical trials for acute ischemic stroke and render the generation of comparable groups receiving intravenous thrombolysis and endovascular treatment difficult. In this context, maximal utilization of clinical registries from real-world patient care became necessary.[17] We took the aforementioned factors into account in a comparative research of the effectiveness and safety of endovascular recanalization (EVT) in acute ischemic stroke versus intravenous thrombolysis alone (IVT) over a period of 4 consecutive years (2008-2011) in the context of a collaborative, prospective stroke registry database of 14,792 ischemic stroke cases from 12 stroke centers in South Korea.[18]

Methods

Study Design and Population

We selected subjects from a prospective, multicenter, nationwide Web-based acute stroke registry database in which all acute stroke cases that were assessed within 7 days of the onset of symptoms were registered. Data were collected between April 2008 and January 2012, through the stroke research network of South Korea. The network consisted of 12 academic and regional stroke centers (Figure S1 in Appendix).[18] Acute stroke management in the participating centers was performed according to the contemporary clinical practice guidelines[19,20] and institutional protocols and at the discretion of the individual physicians who were in charge of patient care. The institutional review boards of each center approved the design and performance of the study.

From the 16,459 acute stroke cases identified in the registry database, patients who were eligible for the current analysis were selected on the basis of the following criteria: (1) stroke patients who had acute ischemic lesions documented by neuroimaging studies; (2) interval between last seen normal and hospital arrival less than 4.5 hours; (3) moderate-to-severe neurologic deficits at presentation, defined as a National Institute of Health Stroke Scale (NIHSS) score of 10 points or more; and (4) administration of recanalization therapy. The exclusion criterion was the unavailability of a modified Rankin Scale (mRS) score at discharge; however, none of cases met this criterion (Figure S2 in Appendix).

Patients who underwent endovascular recanalization with or without intravenous thrombolysis were grouped as an EVT group and were compared with the IVT group. EVT included the intra-arterial use of chemical thrombolytic agents, clot maceration by multiple passages of the microcatheter/microwire through the clot, use of mechanical thrombectomy devices, and stent placement.[21-23]

Outcome Measures of Effectiveness and Safety

The primary outcome was a favorable functional outcome (mRS score of 0-2) at discharge or transfer to in-hospital rehabilitation services. The secondary effectiveness outcome was a favorable functional outcome at 3 months. Safety outcome measures included in-hospital mortality, mortality at 3 months, and symptomatic hemorrhagic transformation (HT). Clinical outcomes were collected prospectively under the approval of research-site institutional review boards as part of an institutional