The effect of different stroke transport methods for patients with suspected acute ischemic stroke (AIS), measured by functional outcome in the Modified Rankin Scale (mRS)

Research Proposal - Matthew Li

Introduction

Background: Ischemic strokes occur with a blood clot obstructing the cerebral arteries. These clots can be fatal, and strokes are some of the leading causes of mortality. Moreover, large vessel occlusion occurs with the occlusion of the large proximal arteries, which poses a greater threat to long term functional outcome.

In-Hospital treatment: Current in-hospital stroke treatment include intravenous thrombolysis (IVT) for smaller clots, and endovascular therapy (EVT) for large vessel occlusions. These treatment options are critically time dependent, and a patient can be rendered ineligible of said treatment if there is any delay. Hence, prehospital stroke transport methods must be optimized to ensure quick treatment times.

Prehospital transport: Current optimized transport paradigms include drip-and-ship (DS), which routes patients to a primary stroke center (PSC) to prioritize IVT, and then a CSC if necessary; drip-and-drive (DD) transports patients to a PSC, and routes a neuro interventionist capable endovascular therapy (EVT) to the same PSC if needed; and mothership (MS), which bypasses patients from a PSC to be transported directly to a CSC prioritizing EVT.

Debate between which stroke paradigm yields the best possible results in terms of functional outcome after 90 days remains firm. This proposal compares the Modified Rankin Scale (mRS) after 90 days to determine which paradigm provides the best possible results.

Hypothesis

The mothership paradigm will provide the best results in terms of functional outcomes measured by the Modified Rankin Scale (mRS) after 90 days.

Purpose

The purpose of this proposal is to determine the best prehospital stroke transport paradigm. This research is imperative, as it holds the potential to reduce transport times between the onset of symptoms and the time to treatment. The reduction of this gap reduces stroke mortality rates, and ultimately mitigates neurological deficits, which are one of the major negative effects of strokes.

Methods and materials

Rapid Arterial oCclusion Evaluation (RACE)::

- Prehospital stroke test used to test for LVO
- A score of ≥ 5 on the RACE scale indicates LVO

Modified Rankin Scale (mRS)

- Used to categorize patients based on functional outcome 90 days after stroke treatment

Comprehensive stroke center

- Advanced stroke center where EVT and IVT can be performed.

Primary stroke center

- Stroke center where IVT prioritized, but EVT equipment is present although not used

Figure 2

Score	Description
0	No symptoms
1	No significant disability. Able to carry out all usual activities, despite some symptoms
2	Slight disability. Able to look after own affairs without assistance, but unable to carry out all previous activities
3	Moderate disability. Requires some help, but able to walk unassisted
4	Moderately severe disability. Unable to attend to own bodily needs without assistance, or unable to walk unassisted
5	Severe disability. Requires constant nursing care and attention, bedridden, incontinent
6	Dead

Figure 2: Modified Rankin Scale

Figure 1

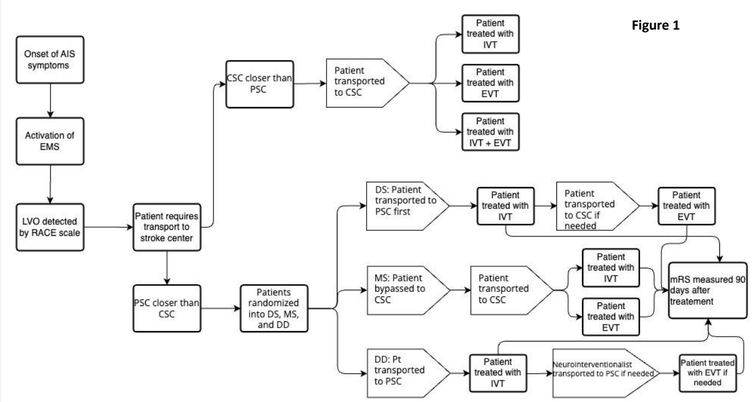

FIGURE 1: After an onset of AIS symptoms and EMS activation, ETA to both stroke centers will be calculated. Patients closer to a CSC will be transported there by default, and no different transport methods will be used. One prerequisite for this study is that a PSC must be closer than a CSC. If this is the case, patients will be randomized into one of the three different transport paradigms (DS, DD, or MS), and transported to their respective stroke center. Patients will then receive treatment (IVT or EVT) at their respective stroke center. After 90 days, patients will be ranked on the mRS, and the results will be compiled to determine which transport paradigm yielded the best functional outcome

Predicted Results

	Mothership	Drip-and-ship
mRS (0-2)	72 (36.4%)	128 (39.3%)
mRS (3-6)	126 (63.6%)	198 (60.7%)

	Drip-and-ship	drip-and-drive
Median mRS on discharge	4	4

These results display how the mRS between the MS and DS relatively similar. Meaning that patients transported with either transport paradigm will have the similar functional outcome results yielded. Moreover, when comparing mRS between DS and DD upon discharge from the stroke center, both results were the same. Meaning there is no significant difference between DS, DD, or MS in terms of mRS.

Conclusion

In conclusion, there was no significant difference between the three different transport paradigm in terms of functional outcome, as measured by the mRS. This proves the hypothesis as incorrect, as the mothership paradigm did not display any benefit over DS and DD.

Discussion

The projected results do not support the hypothesis. In particular, the projected mRS amongst patients is not significantly distinct enough to state that one paradigm is superior to the others. This proposal does have sources of error and limitations. For example, the predicted results included a mRS 90 days after treatment, and a mRS taken upon discharge. It is possible that a unified mRS taken after a definite amount of time could have provided more accurate results.

Review of Literature

Lucio A et al. Comparison of Drip-and-Ship Versus Mothership Delivery Models of Mechanical Thrombectomy Delivery. STROKE.2022

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Behrndtz A et al. Transport Strategy in Patients With Suspected Acute Large Vessel Occlusion Stroke: TRIAGE-STROKE, a Randomized Clinical Trial. Stroke. 2023

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