Paramedic CAT (Critically Appraised Topic)

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Title: The efficacy in implementing mobile stroke units/ambulances to allow for the prehospital administration of thrombolytics to patients experiencing acute ischemic cerebrovascular accidents (CVAs).

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Clinical Scenario:
Paramedics are dispatched to a rural residence for a 47-year-old male patient complaining of limb weakness. They, upon arrival and completion of an assessment, find that the patient is experiencing unilateral arm weakness, facial droop, and has began to slur his speech; the patient's wife notes that her husband first complained of symptoms two hours prior but was hesitant to call 911. An acute CVA is suspected. The patient does not meet any contraindications of stroke bypass protocol and as a result, it is initiated; the paramedics are to transport to a designated stroke centre, the closest of which is 1 hour and 30 minutes from their location. Other than providing comfort and additional support for the patient during rapid transport, there is little more the paramedics may do until arrival at the stroke centre (). The patient will not receive care until 3.5 hours after incident onset at best, and realistically this will be longer as a CT scan must be conducted. Indeed, paramedics currently have no means of differentiating between ischemic strokes and hemorrhagic strokes, and as such, they may not administer the medication needed to treat the problem (particularly in cases of ischemic strokes, as thrombolytics are contraindicated for hemorrhagic varieties). Would the implementation of an ambulance specifically equipped for stroke patients with the ability to differentiate between stroke varieties and administer tissue plasminogen activator (tPA) improve patient outcomes in cases of acute ischemic strokes (AIS)?

Review Question (PICO)
In acute ischemic stroke patients, would prehospital scanning and administration of tPA result in improved patient outcomes?

Databases searched: Cumulative Index of Nursing and Allied Health Literature (CINAHL) and PubMed

Search strategy for CINAHL: (paramedic or ems or emergency medical service or prehospital or pre-hospital or ambulance or emergency medical technician or emt) AND (stroke or cerebrovascular accident or cva or acute ischemic stroke) AND (prehospital thrombolysis or ambulance based thrombolytics)

Limits on search: 2015-2020

Search Strategy for PubMed: (paramedic OR ems or emergency medical services OR emt OR emergency medical services OR prehospital OR pre-hospital OR ambulance) AND (stroke OR cva OR cerebrovascular accident OR ischemic stroke) AND (pre-hospital stroke thrombolytics OR pre-hospital thrombolysis OR ambulance based thrombolysis OR ambulance ct OR ambulance computed tomography OR tpa or tissue plasminogen activator) AND (stroke emergency ambulance OR mobile stroke unit OR stroke emergency mobile)

Limits on search: 2016-2021

Search results: 159 results (CINAHL: 20; PubMed: 139)

Included for review: This CAT chose 3 papers for review

Title, author, year	Study design & LOE	Population	Outcomes	Results	Weaknesses & Strengths
Effects of Ultraearly Intravenous Thrombolysis on Outcomes in Ischemic Stroke Kunz, et al. 2017	Clinical Trial Observational cohort, prospective patient registry Analysis of 3-month functional and mortality outcomes in patients who received intravenous thrombolysis (IVT) in CT-equipped mobile stroke units (MSU)	658 participants who met criteria: consisting of patients who received thrombolytic therapy, either in a Stroke Emergency Mobile vehicle (pre-hospital), or post-admission to hospital	84% of patients receiving IVT within 60 minutes were treated on MSU 43% of patients treated on MSU received IVT within 60 minutes, compared to 6% of those treated in hospital Shorter onset-to-treatment time (OTT) was associated with reduced mortality and a more favourable outcome	Odds ratios for mRS (functioning): mRS ≤1 for OTT 0-60 minutes: 1.87 95% CI (1.12-3.11); 61-120 minutes: 1.06 95% CI (0.71-1.58) mRS ≤3 for OTT 0-60 minutes: 3.01 95% CI (1.48-6.13); 61-120 minutes: 1.38 95% CI (0.81-2.33) Odds ratio for mortality decreased with earlier treatment (treatment 0-60 minutes: 0.26 95% CI (0.10-0.69); 61-120 minutes: 0.42 95% CI (0.20-0.90)	Strengths: first study to examine better 3-month functional outcomes in IVT patients treated within the golden hour (OTT ≤ 60 minutes), consistent with other clinical findings Limitations: MSU scarcely available worldwide, analyses of favourable outcomes completed by unblinded raters, relatively small sample size compared to RCTs, registry-based comparisons cannot be adjusted for unobserved confounders

Title, author, year	Study design & LOE	Population	Outcomes	Results	Weaknesses & Strengths
Effect of the use of ambulance-based thrombolysis on time to thrombolysis in acute ischemic stroke: a randomized clinical trial. Fahkraldeen, Segal, & de Champlain. 2015	Randomized Clinical Trial 7098 stroke activations over 21-month period. 3668 STEMO & 3430 control. Only 1641 STEMO successful activations (45% of total activations)	518 patients to which tPA was administered, were included in the analysis	Alarm-to-treatment time 15 minutes shorter for STEMO patients Thrombolysis rates increased by 12% between STEMO deployment groups and control	No significant risk increase for intracerebral hemorrhage between STEMO groups and non-STEMO groups No increased risk of seven-day mortality	Reflects unpredictable nature of emergency medicine The results do not necessarily translate to improved clinical benefit Questionable generalizability to Canada and elsewhere
Influence of Distance to Scene on Time to Thrombolysis in a Specialized Stroke Ambulance Koch et al. 2016	Secondary retrospective analysis on PHANTOM-S study (clinical trial); reviews whether increasing travel time diminishes benefits of specialized stroke ambulance	Berlin divided into 4 operation zones (within 4, 8, 12, 16 minutes from base) Total patients treated: 530 (200 STEMO) zone 1: n=30 zone 2: n=2 zone 3: n=127 zone 4: n=156	Study shows significant advantage in time for STEMO patients over conventional care (travel radius ≤18 mins from base) Alarm to treatment times were at least 19 mins shorter	All mean times for zone 1 (conventional treatment for vs STEMO) Alarm to imaging: 50.2 vs 37.6 Alarm to treatment: 76.5 vs 41.8 Onset to treatment: 130.8 vs 67.9	A post hoc analysis and was not designed to determine the optimal values for its parameters (base to scene time) May not be generalizable elsewhere due to unique geography, population, and health systems Times may have obscured mean when STEMO was not at base when dispatched

Comments:
Much of the applicable research for this topic descends from the same group of studies, authors, or location. Generalizability becomes difficult when this is the case. Further research should be completed on this topic, ideally under a different environment.

Considerations:
Again, as mentioned above, much of the research stems from the same sets of data, at least those of which fit the criteria of this CAT. While this does not imply that the result are invalid or that the quality of the research is poor, it does suggest the potential for the replication of errors throughout each paper, as well as a difficult application or generalizability in other regions of the world. Further, as admitted by Kunz et al., sample sizes were not as large as a typical RCT. If these results are to be applied elsewhere, a variety of implications must be examined. Cost-benefit analyses must be completed to include the cost of additional training and/or personnel and equipment, paramedics must be sufficiently trained, and dispatch must ensure an algorithm is created to efficiently recognize strokes to send the appropriate response. Moreover, studies underway elsewhere are determining the effectiveness of infarct reducing treatments, rather than thrombolytics, that can be given irrespective of stroke type, making the findings here less important and urgent. Lastly, these studies reviewed urban areas. Although they did show benefit, it seems that rural areas stand to benefit even more, yet they are less likely to have the funds to afford such innovations.

Clinical bottom line:
While these studies have showed great potential of MSUs to increase patient outcome - or at least decrease treatment times - it is difficult to recommend the implementation of the measures based on these results alone. Where and if studies can continue to show efficacy, and certain analyses can be conducted to show a cost and public health benefit, implementation of MSUs or similar vehicles to ambulance services should be considered. In some capacity, this CAT speaks to the benefits of increasing some aspects of the scope of practice in paramedicine, where time is of the essence and prehospital treatments can improve patient outcomes.

References

Fahkraldeen, M., Segal, E., & de Champlain, F. (2015). Effect of the use of ambulance-based thrombolytics on time to thrombolysis in acute ischemic stroke: a randomized clinical trial. *Canadian Journal of Emergency Medicine*, 17(6), 709-712. doi:10.1017/cem.2014.65

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