HHS Public Access

Author manuscript

Stroke. Author manuscript; available in PMC 2015 March 26.

Published in final edited form as:

Stroke. 2013 November ; 44(11): 3109–3113. doi:10.1161/STROKEAHA.113.001938.

35% Good Outcome Rate in IV-tPA treated Patients with CTA Confirmed Severe Anterior Circulation Occlusive Stroke

R. Gilberto González, MD, PhD[1], **Karen L. Furie, MD**[1,9], **Gregory V. Goldmacher, MD, PhD**[1,2], **Wade S. Smith, MD, PhD**[3], **Shervin Kamalian, MD**[1], **Seyedmehdi Payabvash, MD**[1,4], **Gordon J. Harris, PhD**[1], **Elkan F. Halpern, PhD**[1,5], **Walter J. Koroshetz, MD**[6], **Erica C. S. Camargo, MD, PhD**[1,7], **William P. Dillon, MD**[8], and **Michael H. Lev, MD**[1]

[1]Department of Radiology, Massachusetts General Hospital and Harvard Medical School, Boston, MA

[2]ICON Medical Imaging (Beacon Bioscience), North Wales, PA

[3]Department of Neurology, University of California at San Francisco, San Francisco, CA

[4]Department of Radiology, University of Minnesota, Minneapolis, MN

[5]Department of Radiology and Institute for Technology Assessment, Massachusetts General Hospital and Harvard Medical School, Boston, MA

[6]National Institutes of Neurological Disorders and Stroke, Bethesda, MD

[7]Department of Neurology, Boston University Medical Center, Boston, MA

[8]Department of Radiology, University of California at San Francisco, San Francisco, CA

[9]Department of Neurology, Rhode Island Hospital and Warren Alpert Medical School, Brown University, Providence, RI

Abstract

BACKGROUND AND PURPOSE—To determine the effect of IV-tPA on outcomes in patients with severe major anterior circulation ischemic stroke.

METHODS—Prospectively, 649 acute stroke patients had admission NIH stroke scale scores (NIHSS), non-contrast CT, CT angiography (CTA), and 6-month outcome assessed using modified Rankin scale (mRS). IV-tPA treatment decisions were made prior to CTA, at the time of non-contrast CT scanning, as per routine clinical protocol. Severe symptoms were defined as NIHSS>10. Poor outcome was defined as mRS>2. Major occlusions were identified on CTA.

Address correspondence to: **R. Gilberto Gonzalez, MD PhD** Massachusetts General Hospital, Department of Radiology PO Box 9657, Boston, MA02114-9657 Phone: 617-726-8628 Fax: 617-724-3338 rggonzalez@partners.org.

Conflict of Interest

Dr. Shervin Kamalian reports GE Healthcare research support. Dr. Michael H Lev reports research support from GE Healthcare, Department of Defense through CIMIT, and is Consultant to Millennium Pharmaceuticals.

Univariate and multivariate stepwise-forward logistic regression analyses of the full cohort were performed.

RESULTS—Of 649 patients, 188 (29%) presented with NIHSS>10, and 64/188 (34%) of these received IV-tPA. Admission NIHSS, large artery occlusion, and IV-tPA all independently predicted good outcomes, however a significant interaction existed between IV-tPA and occlusion ($p<0.001$). Of NIHSS>10 patients with anterior circulation occlusion, twice the percentage had good outcomes if they received IV-tPA (17/49, 35%), than if they did not (13/77, 17%; $p=0.031$). The "number needed to treat" was 7 (95% CI = 3–60).

CONCLUSIONS—IV-tPA treatment resulted in significantly more good outcomes in severely symptomatic stroke patients with major anterior circulation occlusions. The 35% good outcome rate was similar to rates found in endovascular therapy trials. Vascular imaging may help in patient selection and stratification for trials of IV-thrombolytic and endovascular therapies.

Keywords

computed tomography angiography; ischemic stroke; treatment outcome; tissue-type plasminogen activator; thrombolysis

Introduction

IV-tPA is an effective treatment for acute ischemic stroke.[1, 2] The relationships between arterial occlusion, IV-tPA administration, and outcomes in patients with severe stroke symptoms, however, are largely unknown. The Screening Technology and Outcomes Project in Stroke (STOPStroke) was undertaken to assess the value of computed tomography (CT) technology including CT angiography (CTA) in acute ischemic stroke patients. The study has shown that combining CTA information with the neurological examination provides superior prognostic information than either alone.[3] Because nearly 1 in 6 patients who were recruited into the STOPStroke study received IV-tPA, it was possible to investigate outcomes in patients with specific arterial occlusions. We tested the hypothesis that the efficacy of IV-tPA treatment in patients with severe symptoms depends on the presence of a major anterior circulation artery occlusion that is detectable by CTA.

Methods

Patient cohort

We reviewed the records of 742 consecutive patients who were prospectively enrolled in the Screening Technology and Outcomes Project in Stroke (STOPStroke) between March 2003 and January 2006. The STOPStroke study was completed at the Massachusetts General Hospital and the University of California San Francisco Medical Center as a prospective image-based outcome study. All patients with suspected acute ischemic stroke who presented within 24 hours of symptom onset and had multimodal CT examination (i.e. unenhanced head CT and arch-to-vertex head and neck CTA) were consented for data collection and 6-month follow-up. Exclusion criteria included intracranial hemorrhage, contraindication to iodinated contrast agent, and suffering a stroke while in hospital. During the study period, all patients with suspected stroke or TIA had multimodal CT examination

as part of their routine clinical care in both institutions, except those with a contraindication to intravenous contrast. Surrogate consent was obtained when the patient was unable to communicate. The study received Institutional Review Board approval from both institutions and was Health Insurance Portability and Accountability Act-compliant.

Patients were managed according to our routine clinical workflow, which specifies that the decision to treat with IV-tPA be made immediately at the time of CT scanning, prior to the CTA acquisition. Contraindications to IV-tPA included any hemorrhage on CT and last known normal >3 hours; large CT hypodensity (>1/3 MCA territory) was considered a relative contraindication.

Demographic data, past medical history, and NIHSS scores were obtained at admission. Modified Rankin scale (mRS) scores were obtained at 6 months.[4–6] Favorable outcome was defined as mRS≤2, and poor outcome as mRS>2. Patients were excluded if reliable mRS or NIHSS scores were not obtained. Study staff certified by the American Stroke Association's NIHSS training program obtained the mRS and NIHSS scores.[7]

Scanning procedures

NCCT and arch-to-vertex CTA were performed according to standard protocols with multi-detector CT scanners (LightSpeed; GE Healthcare, Chalfont St. Giles, UK).[8] Representative NCCT parameters were as follows: 120–140 kVp, 170 mA, 2-second scan time, and 5-mm section thickness. Biphasic helical CTA scanning, at the same head tilt, was performed immediately afterward, with 100–140 ml of contrast (Isovue; Bracco Diagnostics, Princeton, NJ) at 3 ml/sec and a 25-second delay (40 seconds for patients in atrial fibrillation). Parameters were 140 kVp, 220–250 mA, 0.8–1.0-second rotation, 2.5-mm section thickness, 1.25-mm reconstruction interval, 3.75-mm/rotation table speed, and 0.75:1 pitch. Source images were reconstructed into standardized maximum intensity projections of the intracranial and extracranial vasculature.

Image Review

Image review was independently performed on a workstation (Impax; Agfa Technical Imaging Systems, Richfield Park, NJ) by neuroradiologists or neurologists (M.H.L., E.C., and W.J.K.) as previously described.[9] Reviewers had information on patient age, sex, and presenting clinical symptoms but were blinded to all information after the initial emergency evaluation.[10] NCCT images were reviewed first, followed by CTA. Disagreements were resolved by consensus. The reviewers recorded both major intracranial arterial occlusions and brain areas with hypodensity considered to have resulted from acute ischemia. A major anterior circulation occlusion was defined as occlusion of the terminal ICA and/or proximal MCA (M1, M2) segments.

Statistical analysis

Comparisons were tested for statistical significance using chi-square 2x4 contingency tables, Fisher exact tests, or t-tests, as appropriate, with significance defined as p≤0.05 (all p-values two-tailed unless noted otherwise). Multivariate binary logistic regression, both with and without stepwise forward likelihood ratio variable entry, was performed using dichotomized

outcome (mRS>2 “poor” versus mRS≤2 “good”). Input variables, adjusted for “time-to-CTA” by forced entry, included admission NIHSS, major vessel occlusion, IV-tPA therapy, and the interaction terms between NIHSS*tPA, and occlusion*tPA. All statistical results were calculated using SPSS (SPSS Inc., 20.0, Chicago, IL, USA).

Results

A total of 742 patients were enrolled in STOPStroke. 90 were excluded for lack of a reliable mRS at 6 months and 3 were excluded for lack of reliable NIHSS scores at admission. Thus 649 patients formed the analyzed cohort, and of these, 101 patients (15.6%) received IV-tPA within 3 hours of stroke onset (86 received IV-tPA only, 15 received both IV-tPA and endovascular therapy). For all patients who received IV-tPA, mean time from symptom onset to administration was 124.5 ± 37.1 (SD) minutes. In patients with NIHSS>10 who received IV-tPA (n= 64/188), mean time from symptom onset to administration was 126.5 ± 36.1 (SD) minutes. The majority of patients who did not receive IV-tPA (~80%, 125/158) were imaged beyond the 3 hr time window for thrombolysis. Tables 1 and 2 show patient demographics, co-morbidities, and endovascular (IA) treatment of both the entire (Table 1) and NIHSS>10 (Table 2) cohorts, stratified by IV-tPA treatment. Fifty of the 101 patients who received IV-tPA had good outcomes (50/101; 50%). This good outcome rate was significantly lower than that of the 346/548 (63%) similar patients who did not receive IV-tPA (p=0.010). However, 342 of these untreated patients had mild clinical symptoms (NIHSS≤5) as compared to 10 in the IV-tPA treated group. If these subsets are removed, there were more good outcomes in those receiving (43/91; 47%) versus not receiving IV-tPA (70/206; 34%, p=0.04).

Multivariate binary logistic stepwise forward regression modeling was performed on the entire STOPStroke cohort, both including (n=649) and excluding (n=618) patients who received endovascular-only treatment. In the model with forward regression and interaction terms, for both groups, only (i) admission NIHSS and (ii) the interaction term between major vessel occlusion and IV-tPA therapy, were significant (p<0.001), supporting that the effects of IV-tPA on outcome vary with the presence or absence of major vessel occlusion. In the binary logistic model without forward regression or interaction terms entered, NIHSS, occlusion, and IV-tPA were all highly significant outcome predictors (p<0.004). When “time-to-CTA” was adjusted for by forced entry into the models, these results were unchanged.

The effect of IV-tPA on good outcome rates for the entire STOPStroke cohort, stratified by admission NIHSS score, is shown in Table 3. For patients with admission NIHSS>5 treated with IV-tPA, the reduction of risk for poor outcome was similar for each of the different subgroups shown in Table 3 (the “number needed to harm” in the NIHSS≤5 group was 10 {95%CI =−18–39%; p=N.S.}). The two groups of patients that most strongly benefitted from IV-tPA were those with (i) *NIHSS of 6-10*, and (ii) *NIHSS>10 with major anterior occlusion* documented by CTA. Stratification by occlusion did not significantly change the results for the NIHSS 6-10 group. The “number needed to treat” in these two classes were 5 (95%CI = 2–53) and 7 (95%CI = 3–60), respectively.

A beneficial effect of IV-tPA treatment in patients presenting with severe neurological symptoms (NIHSS>10) is observed when patients are stratified by the presence of a major anterior circulation occlusion. Chi-square 2x4 contingency table analysis of good versus poor outcomes in NIHSS>10 patients without posterior circulation involvement (n=175, with/without occlusion and with/without IV-tPA administration) disclosed highly significant differences ($p<0.001$). NIHSS>10 patients with major anterior circulation occlusions who received IV-tPA had significantly better outcomes (17/49; 35%) than similar patients who did not receive IV-tPA (13/77; 17%, p=0.031). Although there was a trend towards better outcomes in NIHSS>10 patients *without* major occlusions who received IV-tPA (6/13; 46%) compared to those who did not receive IV-tPA (11/36; 31%), this did not reach significance (p=0.331), likely due to the small cohort size.

These results were essentially identical when the entire cohort of NIHSS>10 patients, including those with both posterior fossa involvement (n=13) and endovascular treatment (n=29), were analyzed (Table 2). In this cohort (n=188), the good outcome rate for those *with* occlusion was 33% (17/51) IV-treated versus 17% (14/84; p=0.034) non IV-treated, compared to 46% (6/13) IV-treated versus 31% (13/40; 33%, p=0.507) non-IV-treated for those *without* occlusion. These percent-good outcome rates were similarly unchanged when the anterior circulation stroke patients with endovascular treatment were excluded (n=151, 104 with occlusion; p=0.07 one-sided). Moreover, when patients with admission CT ASPECTS≤7 were excluded from the full NIHSS>10 cohort (i.e., excluding patients with a relative contraindication to IV-lytic therapy based on admission hypodensity lesion size), the proportion of good outcomes for those *with* occlusion was 40% treated versus 17% untreated (p=0.05), compared to 50% treated versus 33% untreated (p=0.50) for those *without* occlusion.

Discussion

Outcomes of ischemic stroke patients with documented cerebral artery occlusions treated with IV-tPA are not well studied and are poorly understood. The imperative to promptly treat supersedes other considerations, and imaging for vascular occlusion is typically not performed. Patients in the STOPStroke study were unusual in that they underwent CT angiography as part of their initial stroke evaluation following the decision to administer IV-tPA based on the unenhanced CT findings, and these data have revealed new information on the efficacy of IV-tPA. Most importantly, the STOPStroke study indicates that in patients presenting with severe stroke symptoms caused by major anterior circulation artery occlusions, IV-tPA improves outcomes with an efficacy comparable to those found in endovascular therapy trials of like cohorts. [11, 12] The >30% good outcomes rate produced by IV-tPA is a threshold that is considered successful for endovascular therapy. Indeed, according to recent benchmarks agreed on by eight professional societies, “intra-arterial treatment for stroke should … result in a good outcome in at least 30% of patients”.[13] Notably, this benefit was found to be statistically significant in a small number of patients: 49 with NIHSS>10 and anterior circulation occlusions received IV-tPA while 77 did not receive the thrombolytic.

The data presented here are congruent with the large number of research studies on the clinical use of IV-tPA.[14] The findings also help illuminate the results of the Interventional Management of Stroke III trial (IMS III),[15] which was a phase III, randomized, multi-center, open label, 900 subject clinical trial that examined whether a combined intravenous and endovascular approach to recanalization is superior to standard IV-tPA alone when initiated within three hours of acute ischemic stroke onset. Upon the recommendation of the DSMB, enrollment was stopped because the data collected showed no difference in proportion with good clinical outcome for those patients treated with IV-tPA alone versus those treated with IV-tPA plus intra-arterial therapy (38.7% versus 40.8%, respectively). An uncertainty in the IMS III trial was that arterial occlusion status in the IV-tPA only treated group was not documented.

The efficacy of IV-tPA in major anterior circulation occlusion patients that we observed in the STOPStroke cohort is also in line with the results of the SYNTHESIS trial in which the clinical efficacy of endovascular treatment was compared to IV-tPA.[16] It was reported that at 3 months 30.4% of endovascular-therapy group and 34.8% of the IV-tPA group were alive without disability. The SYNTHESIS trial also did not document arterial occlusion in the IV-tPA group. MR RESCUE is a third major trial in which IV-tPA was compared to endovascular therapy.[17] Again, the 3-month post treatment outcomes of patients with severe ischemic stroke were not significantly different between patients who received IV-tPA and those who were treated endovascularly; of note, arterial occlusions were documented in all treated patients.

The other major finding in this study is confirmation of the observation by Ingall et al. that patients with moderate symptoms (NIHSS 6-10) are most likely to benefit from IV-tPA. Approximately half of all patients with moderate symptoms in STOPStroke have good outcomes without treatment, however nearly 75% of such patients have good outcomes if they are given IV-tPA. What is new is that only a minority (29%, 32/109) of these patients had occlusions identifiable by CTA, yet IV-tPA was still highly beneficial. A likely explanation is that patients with moderate symptoms are more likely to have CTA-*undetected* distal branch occlusions that are readily amenable to lysis by IV-tPA. Good outcomes in patients with occlusions on CTA were much less common, even if treated with IV-tPA, emphasizing the need for improved treatments for this group.

Patients in STOPStroke were recruited prospectively without regard to anterior or posterior circulation symptoms, and image analysis was performed blinded to the clinical CTA reports or outcomes. Although the possibility of selection bias exists because CTA was performed for specific clinical presentations, the potential for such bias was limited by the fact that STOPStroke enrollment required all patients with acute ischemic symptoms to undergo NCCT followed by CTA - regardless of symptom severity - unless specifically contraindicated. It is also noteworthy that, despite the observational nature of our study and lack of randomization, differences in outcome between the treated and untreated groups are unlikely to be biased by the presence or absence of large vessel occlusion, because the decision to administer IV-tPA was made immediately following the unenhanced CT, *prior to - and independent of - the CTA results*. Moreover, because admission infarct size is another possible source of bias, we performed a subgroup analysis excluding patients with

low admission ASPECTS scores (≤7), which resulted in similar good outcome rates as our primary analysis.

There are other potential limitations of our study. The confidence intervals for the "number needed to treat" and "number needed to harm" analyses are wide and underpowered. Also, data is unavailable regarding the number and specific reasons for non-enrollment, although our ability to obtain surrogate consent may have, in part, mitigated any potential bias towards enrolling less severe strokes. Indeed, although our cohort was treated prior to ECASS III, standardization of statins in acute stroke management, and widespread acceptance of the more aggressive use of IV-tPA in patients with relative contraindications, it is striking that our percent good outcomes - even in severely symptomatic (NIHSS>10) IV-tPA treated patients with large vessel occlusion - so closely matches that of more recent trials of both IV and IA therapy in similarly symptomatic patients. [11, 12] The value of IV-tPA in such severely symptomatic patients with CTA proven large vessel occlusion has not been previously been emphasized.

In summary, STOPStroke has revealed that treatment with IV-tPA results in more good outcomes in patients with severe stroke symptoms with major anterior circulation occlusions, than in similar patients that did not receive IV-tPA. Treatment utilizing targeted vascular imaging such as CTA may be important for patient selection and stratification in clinical trials of ischemic stroke, including direct comparisons between IV thrombolytic and endovascular approaches.

Acknowledgement

The authors thank all STOPStroke research coordinators and fellows for assistance in data gathering and patient enrollment.

Source of Funding

This work was supported by the National Institute of Health Agency for Health Care Policy and Research (AHCPR), R01 HS11392-01A1. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

References

1. NINDS. Tissue plasminogen activator for acute ischemic stroke. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. N Engl J Med. 1995; 333:1581–1587. [PubMed: 7477192]
2. Hacke W, Kaste M, Bluhmki E, Brozman M, Davalos A, Guidetti D, et al. Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke. N Engl J Med. 2008; 359:1317–1329. [PubMed: 18815396]
3. Gonzalez RG, Lev MH, Goldmacher GV, Smith WS, Payabvash S, Harris GJ, et al. Improved outcome prediction using CT angiography in addition to standard ischemic stroke assessment: results from the STOPStroke study. PLoS One. 2012; 7:e30352. [PubMed: 22276182]
4. Bonita R, Beaglehole R. Recovery of motor function after stroke. Stroke. 1988; 19:1497–1500. [PubMed: 3201508]
5. Rankin J. Cerebral vascular accidents in patients over the age of 60. II. Prognosis. Scott Med J. 1957; 2:200–215. [PubMed: 13432835]
6. van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. Interobserver agreement for the assessment of handicap in stroke patients. Stroke. 1988; 19:604–607. [PubMed: 3363593]

7. Lyden P, Raman R, Liu L, Emr M, Warren M, Marler J. National Institutes of Health Stroke Scale certification is reliable across multiple venues. Stroke. 2009; 40:2507–2511. [PubMed: 19520998]
8. Lev, M.; Gonzalez, R. CT angiography and CT perfusion imaging. In: AW, T.; JC, M., editors. Brain mapping: The methods. Academic Press 427–484; San Diego: 2002. p. 427-484.
9. Camargo EC, Furie KL, Singhal AB, Roccatagliata L, Cunnane ME, Halpern EF, et al. Acute brain infarct: detection and delineation with CT angiographic source images versus nonenhanced CT scans. Radiology. 2007; 244:541–548. [PubMed: 17581888]
10. Lev MH, Farkas J, Gemmete JJ, Hossain ST, Hunter GJ, Koroshetz WJ, et al. Acute stroke: improved nonenhanced CT detection--benefits of soft-copy interpretation by using variable window width and center level settings. Radiology. 1999; 213:150–155. [PubMed: 10540655]
11. Fargen KM, Meyers PM, Khatri P, Mocco J. Improvements in recanalization with modern stroke therapy: a review of prospective ischemic stroke trials during the last two decades. J Neurointerv Surg. 2012
12. Saver JL, Jahan R, Levy EI, Jovin TG, Baxter B, Nogueira RG, et al. Solitaire flow restoration device versus the Merci Retriever in patients with acute ischaemic stroke (SWIFT): a randomised, parallel-group, non-inferiority trial. Lancet. 2012; 380:1241–1249. [PubMed: 22932715]
13. Sacks D, Black CM, Cognard C, Connors JJ 3rd, Frei D, Gupta R, et al. Multisociety Consensus Quality Improvement Guidelines for Intraarterial Catheter-directed Treatment of Acute Ischemic Stroke, from the American Society of Neuroradiology, Canadian Interventional Radiology Association, Cardiovascular and Interventional Radiological Society of Europe, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of NeuroInterventional Surgery, European Society of Minimally Invasive Neurological Therapy, and Society of Vascular and Interventional Neurology. J Vasc Interv Radiol. 2013; 24:151–163. [PubMed: 23369552]
14. Lees KR, Bluhmki E, von Kummer R, Brott TG, Toni D, Grotta JC, et al. Time to treatment with intravenous alteplase and outcome in stroke: an updated pooled analysis of ECASS, ATLANTIS, NINDS, and EPITHET trials. Lancet. 2010; 375:1695–1703. [PubMed: 20472172]
15. Broderick JP, Palesch YY, Demchuk AM, Yeatts SD, Khatri P, Hill MD, et al. Endovascular therapy after intravenous t-PA versus t-PA alone for stroke. N Engl J Med. 2013; 368:893–903. [PubMed: 23390923]
16. Ciccone A, Valvassori L, Nichelatti M, Sgoifo A, Ponzio M, Sterzi R, et al. Endovascular treatment for acute ischemic stroke. N Engl J Med. 2013; 368:904–913. [PubMed: 23387822]
17. Kidwell CS, Jahan R, Gornbein J, Alger JR, Nenov V, Ajani Z, et al. A trial of imaging selection and endovascular treatment for ischemic stroke. N Engl J Med. 2013; 368:914–923. [PubMed: 23394476]

Table 1

Entire STOPStroke Cohort

	All Patients (n=649)	No IV-tPA (n=548)	IV-tPA (n=101)	p-value
Men, n (%)	330 (51%)	281 (51%)	49 (49%)	0.794
Age (year), mean (SD)	68.3 ± 15.5	68.3 ± 15.3	68.4 ± 16.2	0.562
NIHSS, median (IQR)	5 (2–12)	4 (2–11)	9 (4–16)	<0.001
ASPECT <7, n (%)	121 (19%)	93 (17%)	28 (28%)	0.013
Glucose, mean (SD)	135 ± 56	136 ± 57	128 ± 49	0.930
PMH, n (%)				
AF	137 (21%)	107 (20%)	30 (30%)	0.034
CAD	147 (23%)	118 (22%)	29 (29%)	0.159
DM	120 (18%)	100 (18%)	20 (20%)	0.735
HLP	190 (29%)	155 (28%)	35 (35%)	0.192
HTN	393 (61%)	328 (60%)	65 (65%)	0.403
Smoking, n (%)	201 (31%)	176 (32%)	25 (25%)	0.200
Occlusion, n (%)	221 (34%)	158 (29%)	63 (62%)	<0.001
IA tx, n (%)	31 (5%)	16 (3%)	15 (15%)	<0.001
Post Fossa, n (%)	26 (4%)	22 (4%)	4 (4%)	0.782
mRS, median (IQR)	2 (0–3.2)	1 (0–3)	2 (1–4)	<0.001
Poor outcome (mRS >2), n (%)	253 (39%)	202 (37%)	51 (50%)	0.010

NIHSS = NIH stroke scale score; ASPECT = admission Alberta Stroke Program Early CT score ≤7; PMH = past medical history (AF atrial fibrillation, CAD coronary artery disease, DM diabetes mellitus, HLP hyperlipidemia, HTN hypertension); occlusion = presence of major circle-of-Willis occlusion on admission CTA; IA tx = endovascular (intra-arterial) treatment; Post Fossa = posterior fossa involvement; mRS = 6-month modified Rankin score; poor outcome = 6-month mRS<2.

Table 2

STOPStroke cohort with admission NIHSS> 10

	All Patients (n=188)	No IV-tPA (n=124)	IV-tPA (n=64)	p-value
Men, n (%)	88 (47%)	55 (44%)	33 (51%)	0.448
Age (year), mean (SD)	69.5 ± 16.6	68.9 ± 16.1	70.8 ± 17.5	0.457
NIHSS, median (IQR)	16 (14–19)	16 (13–19)	17 (14–20)	0.826
ASPECT ≤7, n (%)	81 (43%)	54 (43%)	27 (42%)	0.980
Glucose, mean (SD)	143 ± 60	147 ± 66	135 ± 49	0.221
PMH, n (%)				
AF	59 (31%)	38 (31%)	21 (33%)	0.909
CAD	47 (25%)	31 (25%)	16 (25%)	0.858
DM	38 (20%)	23 (18%)	15 (33%)	0.033
HLP	52 (28%)	32 (26%)	20 (31%)	0.579
HTN	113 (60%)	74 (60%)	39 (61%)	0.980
Smoking, n (%)	51 (27%)	34 (27%)	17 (27%)	0.862
Occlusion, n (%)	135 (72%)	84 (68%)	51 (80%)	0.117
IA tx, n (%)	29 (15%)	15 (12%)	14 (22%)	0.112
Post Fossa, n (%)	13 (7%)	11(9%)	2 (3%)	0.22
mRS, median (IQR)	4 (2–6)	4 (3–6)	3 (1–6)	0.051
Poor outcome (mRS >2), n (%)	138 (73%)	97 (78%)	41 (64%)	0.054

NIHSS = NIH stroke scale score; ASPECT = admission Alberta Stroke Program Early CT score ≤7; PMH = past medical history (AF atrial fibrillation, CAD coronary artery disease, DM diabetes mellitus, HLP hyperlipidemia, HTN hypertension); occlusion = presence of major circle-of-Willis occlusion on admission CTA; IA tx = endovascular (intra-arterial) treatment; Post Fossa = posterior fossa involvement; mRS = 6-month modified Rankin score; poor outcome = 6-month mRS>2.

Table 3

Effect of IV-tPA on Good Outcome rates (n, %) in the Entire STOPStroke Cohort, Stratified by Admission NIHSS score.

All patients (n=649)			
Outcome	Good	Poor	p-value
No IV-tPA (n=548)	63% (346/548)	37% (202/548)	0.007
IV-tPA (n=101)	50% (50/101)	50% (51/101)	
NIHSS >5 patients (n=297)			
Outcome	Good	Poor	p-value
No IV-tPA (n=206)	34% (70/206)	66% (136/206)	0.021
IV-tPA (n=91)	47% (43/91)	53% (48/91)	
NIHSS 0–5 patients (n=352)			
Outcome	Good	Poor	p-value
No IV-tPA (n=342)	81% (276/342)	19% (66/342)	0.31
IV-tPA (n=10)	70% (7/10)	30% (3/10)	
NIHSS 6–10 patients (n=109)			
Outcome	Good	Poor	p-value
No IV-tPA (n=82)	52% (43/82)	48% (39/82)	0.038
IV-tPA (n=27)	74% (20/27)	26% (7/27)	
NIHSS 11–15 patients (n=79)			
Outcome	Good	Poor	p-value
No IV-tPA (n=55)	35% (19/55)	65% (36/55)	0.15
IV-tPA (n=24)	50% (12/24)	50% (12/24)	
NIHSS 16+ patients (n=109)			
Outcome	Good	Poor	p-value
No IV-tPA (n=69)	12% (8/69)	88% (61/69)	0.034
IV-tPA (n=40)	27% (11/40)	72% (29/40)	

NIHSS = NIH stroke scale score; all p-values Fisher's Exact (one-tailed)