Outcomes of a Contemporary Cohort of 536 Consecutive Patients With Acute Ischemic Stroke Treated With Endovascular Therapy

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Background and Purpose—We sought to assess outcomes after endovascular treatment/therapy of acute ischemic stroke, overall and by subgroups, and looked for predictors of outcome.

Methods—We used data from a mandatory, population-based registry that includes external monitoring of completeness, which assesses reperfusion therapies for consecutive patients with acute ischemic stroke since 2011. We described outcomes overall and by subgroups (age ≤ or >80 years; onset-to-groin puncture ≤ or >6 hours; anterior or posterior strokes; previous IV recombinant tissue-type plasminogen activator or isolated endovascular treatment/therapy; revascularization or no revascularization), and determined independent predictors of good outcome (modified Rankin Scale score ≤2) and mortality at 3 months by multivariate modeling.

Results—We analyzed 536 patients, of whom 285 received previous IV recombinant tissue-type plasminogen activator. Overall, revascularization (modified Thrombolysis In Cerebral Infarction scores, 2b and 3) occurred in 73.9%, 5.6% developed symptomatic intracerebral hemorrhages, 43.3% achieved good functional outcome, and 22.2% were dead at 90 days. Adjusted comparisons by subgroups systematically favored revascularization (lower proportion of symptomatic intracerebral hemorrhages and death rates and higher proportion of good outcome). Multivariate analyses confirmed the independent protective effect of revascularization. Additionally, age >80 years, stroke severity, hypertension (deleterious), atrial fibrillation, and onset-to-groin puncture ≤6 hours (protective) also predicted good outcome, whereas lack of previous disability and anterior circulation strokes (protective) as well as and hypertension (deleterious) independently predicted mortality.

Conclusions—This study reinforces the role of revascularization and time to treatment to achieve enhanced functional outcomes and identifies other clinical features that independently predict good/fatal outcome after endovascular treatment/therapy. (Stroke. 2014;45:1046-1052.)

Key Words: brain ischemia • cerebral revascularization • endovascular procedures • stroke • thrombectomy

Intravenous thrombolysis (IVT) is the only effective therapy for acute ischemic stroke (AIS), but its efficacy is limited, mainly among patients with large-vessel occlusions.1,2 High percentages of patients with AIS are left untreated because of contraindications or delayed hospital arrival, or are treated but not revascularized. Stroke physicians have long tried for alternative therapies that offer extended time windows, higher revascularization rates, or suit patients who cannot be treated with IVT because of contraindications. Among these, endovascular therapies, and more specifically mechanical thrombectomy, had become widespread in routine practice before publication of the Intra-arterial Versus Systemic Thrombolysis for Acute Ischemic Stroke (SYNTHESIS),3 the IMS-III,4 and the MR RESCUE trials,5 despite lack of positive evidence. It...
is predictable, however, that the limitations of these studies will encourage stroke researchers and industry to test endovascular treatment/therapy (EVT) efficacy in new trials.

In Catalonia, EVT was performed regularly from 2009 onward. However, the lack of well-established evidence prompted the Stroke Program (a section of the Health Department of Catalonia) to monitor such therapy as a measure of caution through a mandatory registry. The Web-based registry SONIIA (Sistema Online d’Informació de l’Ictus Agut) was set up in January 2011. The main goals of this study were to assess outcomes of EVT overall and by patients’ subgroups in a prospective cohort of consecutive patients with AIS and to identify independent predictors of clinical outcomes.

Methods

Study Setting

This observational, multicenter study is based on prospectively collected data from consecutive patients with AIS treated with EVT (with/without previous IVT) from January 2011 to December 2012. Completeness of the series available in the SONIIA registry wasexternally monitored by members of the Stroke Program not involved in clinical practice. Undeclared cases were retrospectively included in the registry (for further details, see Methods and Figure I in the online-only Data Supplement).

Within the study period, acute stroke care in Catalonia was based on a network of 17 treating hospitals, including 7 comprehensive stroke centers (CSCs), 7 primary stroke centers (PSCs), and 3 community hospitals operating on a telestroke system. All 3 levels have capacity to deliver IVT, whereas CSCs perform all EVT. CSCs share some professional resources (mobile neurointerventional teams) so that every day, 4 CSCs offer a 24-hour service to cover the whole Catalan territory. Furthermore, each CSC has a 24-hour, onsite neurointerventionist who is responsible for prealerting the neurointerventional team. This team includes a vascular neurointerventionist who establishes the need of EVT following a common protocol (for further details see Methods and Table I in the online-only Data Supplement). Briefly, all patients with AIS with no contraindication for IVT who arrive within the first 4.5 hours receive the standard dose of recombinant tissue-type plasminogen activator (0.9 mg/kg) at their local centers (either community hospitals through telestroke, PSCs or CSCs). Patients refractory to, or ineligible for, IVT (including stroke onset beyond 4.5 hours, unknown onset, or wake-up stroke) are preselected for EVT according to clinical criteria (National Institutes of Health Stroke Scale [NIHSS] ≥20 or suspicion of large-vessel occlusion). Subsequently, at the CSC, EVT indication is based on demonstration of a large-vessel occlusion by noninvasive vascular imaging and presence of signs of limited early infarction before transferring the patient to the angiography. Multimodal imaging (MRI or computed tomography perfusion) is recommended in patients beyond 4.5 hours from stroke onset. The specific interventional modalities (intra-arterial thrombolysis, mechanical thrombectomy, or a combined approach) and application of anesthesia or conscious sedation are up to the interventionalist preference.

The SONIIA registry satisfies all legal requirements mandated by the local law of protection of personal data. The study was performed according to local ethical guidelines and with the corresponding patient’s permission (for the endovascular procedure and data entry in the registry).

Definition of Patients’ Subgroups

The registry includes a reduced core set of clinical and angiographic variables. At baseline, we record age, sex, prestroke medical and functional status, clinical data (time of stroke onset and NIHSS obtained by certified neurologists), and specific details about the endovascular procedure (onset-to groin puncture [OTP], treatment modality, and preprocedure and postprocedure angiographic data). At 24 to 36 hours, we record the NIHSS, the occurrence of symptomatic intracerebral hemorrhages (SICH) as defined per the SITS-MOST protocol, and the occurrence of death. At 3 months, the survival and functional status (modified Rankin scale [mRS]) are obtained by face-to-face or telephone-based interviews performed by local, unblinded, certified investigators.

Patients’ subgroups were defined as follows: (1) age at stroke onset up to 80 years versus patients >80 years; (2) anterior circulation versus posterior circulation strokes; (3) primary EVT (EVT alone) versus EVT and previous IVT; (4) OTP up to 6 hours versus OTP beyond 6 hours; and (5) revascularization (as defined by a modified TICI score 2b-3 at the end of the EVT) versus no revascularization. Preprocedure and postprocedure angiograms were evaluated and classified by local investigators in each center.

Outcome Measures

Clinical outcome variables were agreed on a priori by a reduced group of local stroke leaders: (1) SICH was defined as the percentage of EVT patients that developed a symptomatic cerebral bleeding (SITS-MOST definition) within the first 24 to 36 hours postprocedure. (2) All-cause mortality at 3 months (fatal outcome). (3) Functional independence (good outcome); percentage of patients with EVT who achieved functional independence at 3 months poststroke, as established by a modified Rankin Scale ≤2.

For patients declared lost to follow-up at 3 months by local collaborators, efforts were made to retrieve vital and functional status. When 3-month outcomes could not be retrieved, the worst possible outcome was assigned (ie, patients with survival unknown were declared dead, and those known to be alive but with missing mRS values were assigned an mRS of 4–5). Patients with missing radiological follow-up at 24 to 36 hours were recorded as SICH positive if there was neurological worsening at 24 to 36 hours (NIHSS increase of ≥4 points at 24–36 hours).

Statistical Analyses

We excluded patients with diagnostic-only angiographies because inclusion of such cases was not complete, thus preventing us from an intention-to-treat analysis. We described frequencies and means (SD) or medians (first and third quartiles) for all baseline clinical and angiographic characteristics and compared them by patients’ subgroups using χ2 test, t test, or Kruskal-Wallis test, as needed. We described outcomes using frequencies and 95% confidence intervals (95% CIs) and compared them by patients’ subgroups using χ2 test.

Odds ratios (ORs) for the association of relevant subgroups with outcomes were estimated using logistic regression models adjusting for age, NIHSS, and OTP. OTP was dichotomized (OTP ≤ or >6 hours) when entered as a variable of interest. To identify independent predictors of good and fatal outcomes at 3 months, we performed stepwise logistic regression using a backward selection algorithm with a threshold significance level of 0.2 for removal from the model. Dichotomized subgroups variables were forced in the models together with other candidate variables that were selected on the basis of a significance level <0.2 in bivariate comparisons.

All analyses were performed with STATA version 11.0.

Results

The study included 536 patients with AIS who underwent EVT. Mechanical thrombectomy was performed in 485 (90.5%) patients, 40 (7.5%) had combined pharmacological-mechanical approaches, and the remaining 11 (2.0%) had intra-arterial thrombolyis. Mean age of patients was 67.5 ±13.4 years, 294 (54.9%) were males, and the median baseline NIHSS was 17.5 (13, 21). A total of 285 patients (53%) received previous IVT, and the remaining 251 (46.8%) underwent a primary endovascular intervention. The median OTP time was 277 minutes (190, 395), median door-to-puncture time was 115 minutes (75, 162), and median EVT duration was 95 minutes (60, 135). For patients who received previous IVT, the onset-to-treatment time was 118 (70, 183) minutes (Table II
in the online-only Data Supplement for baseline characteristics overall and by subgroups). Regarding the occlusion level, 471 (87.9%) patients had anterior circulation occlusions, specifically, 31 (6.6%) proximal ICA, 78 (16.6%) distal ICA and T-ICA, 57 (12.1%) tandem occlusions, 247 (52.4%) M1 occlusions, 57 (12.1%) M2 occlusions, and 1 (0.2%) patient had A1 occlusion. Posterior circulation strokes occurred in 65 (12.1%) patients, of whom 55 (84.6%) had basilar artery occlusions (26 proximal, 13 middle, and 16 distal), 6 (9.2%) posterior cerebral artery, and 4 (6.2%) patients had vertebral artery occlusions. Overall, 73.9% (95% CI: 69.9–77.6) interventions achieved revascularization at the end of the EVT (Table III in the online-only Data Supplement for final TICI scores by occlusion level). Symptomatic cerebral bleedings were observed in 30 (5.6%) patients (Table III in the online-only Data Supplement for differences by occlusion level). At 3 months, 119 out of 536 (22.2%) patients were dead, and 232 out of 536 (43.3%) patients achieved a good functional outcome (Figure 1).

Subgroups' analyses showed that revascularization was inversely associated with SICH (3% versus 12.9%; \( P < 0.001 \)) and mortality rates (15.2% versus 42.1%; \( P < 0.001 \)). Revascularization also showed higher rates of functional independence at 3 months (53.5% versus 14.3%; \( P < 0.001 \); Table 1; Figure 1). Lower mortality rates at 3 months were seen in patients with anterior circulation strokes and among those ≤ 80 years (Table 1). Furthermore, patients >80 years of age showed a reduced rate of good functional outcome (17.3% versus 47.9%; \( P < 0.001 \)). Figure 2 illustrates the ORs for the association of relevant subgroups with SICH, fatal, and good outcome at 3 months after adjustment by age, baseline NIHSS, and OTP.

Logistic regression models to look for predictors of good and fatal outcome at 3 months were performed. Revascularization was the strongest independent predictor of both good (OR: 8.12; 95% CI: 4.6–14.3) and fatal outcomes (OR: 0.21; 95% CI: 0.13–0.34; Table 2). Aside from revascularization, stroke severity (NIHSS >14), hypertension, and age >80 years showed a deleterious, independent effect on good outcome, whereas atrial fibrillation increased chances of good outcome. Independent predictors of mortality included age >80 years and hypertension, which increased the risk of death, whereas anterior circulation strokes and prestroke mRS <2 reduced the risk of death. Because revascularization is also an intermediate outcome, we run the models without inclusion of revascularization. The resulting models retained all the independent predictors shown by the initial models with the addition of OTP ≤ 6 hours that predicted good outcome (OR: 1.75; 95% CI: 1.11–2.77). Figure 3 shows the estimated probability of good outcome by time until groin puncture and by categories of baseline NIHSS.

**Discussion**

This observational study is likely to be among the largest prospective cohorts of patients with AIS treated with EVT. Remarkably, all patients were recruited within a 2-year time span. This must be taken into account because interhospital variability in terms of the specific endovascular procedures and mechanical devices used and the clinical protocols applied were likely to be of marginal influence, making the cohort homogeneous. Furthermore, the particular conditions under which the study was performed (mandatory declaration and subsequent external monitoring to guarantee consecutive inclusion) together with involvement of all CSCs within Catalonia make this series of patients fully representative from a territorial perspective and in terms of results.

Our study shows different clinical outcomes by patients' subgroups and points out revascularization as a critical...
intermediate outcome and the strongest independent predictor of good outcome and death. The meta-analysis by Rha et al. demonstrated a strong correlation between revascularization and outcome, confirming that revascularization and subsequent reperfusion are essential for preservation of brain tissue. Percentages of good and fatal outcomes according to revascularization in Rha’s review and our study are similar, with good outcome rates ≈51% to 54% in case of revascularization (11% to 14% in nonrevascularized) and fatal outcomes seen in 12% to 15% of patients achieving revascularization (41% to 42% in nonrevascularized). Timing of revascularization is also crucial, with evidence showing that good outcome after technically successful angiographic revascularization is time dependent. Recent publications have supported the need of speeding up

Table 1. Outcomes After EVT in the Overall Cohort and by Subgroups

<table>
<thead>
<tr>
<th>Overall Cohort</th>
<th>Anterior Circulation</th>
<th>Posterior Circulation</th>
<th>Previous IV r-tPA</th>
<th>EVT Alone</th>
<th>Age ≤80 y</th>
<th>Age &gt;80 y</th>
<th>OTP ≤6 h</th>
<th>OTP &gt;6 h</th>
<th>Revascularization</th>
<th>No Revascularization</th>
</tr>
</thead>
<tbody>
<tr>
<td>SICH</td>
<td>30 (5.6)</td>
<td>25 (5.3)</td>
<td>5 (7.7)</td>
<td>13 (4.5)</td>
<td>17 (6.8)</td>
<td>25 (5.5)</td>
<td>5 (6.2)</td>
<td>17 (4.5)</td>
<td>13 (8.4)</td>
<td>12 (3)</td>
</tr>
<tr>
<td>Mortality</td>
<td>119 (22.2)</td>
<td>97 (20.6)</td>
<td>22 (33.9)</td>
<td>59 (20.7)</td>
<td>60 (23.9)</td>
<td>92 (20.2)</td>
<td>27 (33.8)</td>
<td>83 (21.7)</td>
<td>36 (23.4)</td>
<td>60 (15.2)</td>
</tr>
<tr>
<td>mRS ≤2</td>
<td>232 (43.3)</td>
<td>207 (44)</td>
<td>25 (38.5)</td>
<td>131 (45.8)</td>
<td>101 (40.4)</td>
<td>218 (47.9)</td>
<td>14 (17.3)</td>
<td>177 (46.3)</td>
<td>55 (35.7)</td>
<td>212 (53.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>39 (4–48.6)</td>
<td>26.7–51.4</td>
<td>39.9–51.8</td>
<td>34.2–46.8</td>
<td>43.2–52.6</td>
<td>9.8–27.3</td>
<td>41.2–51.5*</td>
<td>28.2–43.8*</td>
<td>48.5–58.5*</td>
</tr>
</tbody>
</table>

Data shown are n (%; 95% confidence intervals). All outcomes are calculated for the entire cohort (n=536). EVT indicates endovascular treatment/therapy; mRS, modified Rankin scale; OTP, onset-to-groin puncture; r-tPA, recombinant tissue-type plasminogen activator; and SICH, symptomatic intracerebral hemorrhages.

*P value <0.05.
†P value <0.01.
‡P value <0.001.

Footnote: Groups in brackets are used as reference. Adjusted by age, NIHSS and OTP (onset-to-puncture time).

Figure 2. Risk-adjusted probability of symptomatic intracerebral hemorrhages (SICH), all-cause mortality, and good functional outcome according to subgroups.
The results of our large prospective cohort point in the same direction: significantly and consistently better clinical outcomes when revascularization is achieved, and increased odds of good outcome the shorter the OTP is. Additionally, our data show a sustained relationship between OTP and good outcome regardless of the baseline NIHSS category (Figure 3).

In this study, coexistence of atrial fibrillation doubled the chances of being independent at 90 days. The association of atrial fibrillation with revascularization after IVT has been reported previously, and might be pointing at a specific stroke pathogenesis or clot composition that is more easily broken up by the action of thrombolytic or endovascular therapies. However, another recent article showed evidence of the opposite; that is, increased likelihood of successful revascularization after EVT of intracranial occlusions secondary to a proximal carotid artery stenosis or occlusion, compared with cardioembolic and cryptogenic strokes. In our study, neither an interaction nor a confusion effect of anticoagulation on such association was found, suggesting a true association of atrial fibrillation with functional independence.

The “time-is-brain” concept supports the idea that pretreatment with IVT might favor better final outcomes because patients undergoing IVT in the first place would benefit from a straightforward and quicker approach. However, a recent meta-analytic review of reperfusion therapies showed no differences in outcomes across reperfusion strategies. Similarly, our study does not show an association between previous IVT and better outcomes, despite shorter OTP times in this subgroup. Whether this finding was related to a rescue therapy (in patients with documented persistent occlusion) rather than a bridging approach in our series is unknown. In considering functional independence rates in our cohort and those of recently published trials, it is worth mentioning that, in our cohort, all patients were selected for EVT according to vascular and radiological criteria not generally applied in such trials, therefore making direct comparisons inappropriate.

Our registry includes a limited number of variables. We do not collect enough data to get into details on futile recanalization, but in our study, the mismatch rate between recanalization and good outcome was 30.6%, a proportion that would be in the lower edge range of futile recanalization rates reported by...
trials (26% to 45%).\textsuperscript{17–21} Another aspect not recorded in our registry is that referring to specific details of the endovascular procedure, such as the use of antithrombotic medication during the procedure, the brand name of the mechanical device deployed in each case or the number of passes. Considering the effectiveness profile of diverse mechanical devices, with the stent-retrievers, Solitaire and Trevo,\textsuperscript{22–25} showing better outcomes compared with the former Merci retriever,\textsuperscript{26,27} these data would have been useful. A retrospective review of devices used throughout the study period by our CSCs showed rates >85% for the Solitaire and Trevo devices in all hospitals but one, where the rate dropped to 53%. Thus, the results of our cohort would be largely attributable to the Solitaire and Trevo systems, although individual associations cannot be performed. A key limitation of this study is the absence of a contemporary control group, but the SONIIA registry was designed to recruit only information about patients undergoing specific reperfusion therapies. Similarly, pre- and post-EVT TICI scores and clinical outcomes were assessed by unblinded, although certified, stroke professionals. Finally, we cannot report on the total numbers, or reasons, whereby patients thought to be EVT candidates eventually failed to undergo EVT (after assessment at CSCs) since such cases were not consecutively registered. This study has some strengths, too. First, it is a population-based study because EVT for AIS is not available outside the designated CSC and, thus, there were no patients undergoing endovascular therapy outside the network of stroke centers involved in the study. Moreover, the preplanned, external monitoring of the registry was established to guarantee completeness of the series and, thus, avoid inclusion bias. As a consequence, our cohort of patients with EVT represents the complete endovascular activity for AIS in our territory throughout the study period. Finally, it is relevant to say that the study period (January 2011 to December 2012) reflects stroke care in the pre-IMS III era,\textsuperscript{4} a time when EVT was fairly widespread across Western countries despite lack of firm evidence. This main reason justifies why the Catalan Health Administration required mandatory declaration of such therapies to a registry.

**Conclusions**

This observational, population-based study adds evidence for the pivotal role of revascularization and time to treatment in patients with AIS treated with EVT. It also shows that age and stroke severity, along with some patients’ features (particularly atrial fibrillation and hypertension), independently predict outcome after EVT. Importantly, these findings are based on a large cohort of contemporary patients with stroke treated with EVT in a closed territory, therefore illustrating real outcomes of current interventional stroke care.
Appendix

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Júlia Saura, Josep Maria Soler Insa (Hospital Fundació Althaia);
Josep Maria Aragonés (Hospital General de Vic);
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Disclosures
Dr Dávalos has received consultancy fees from Coviden as member of the Executive Committee of the Solitaire FR Thrombectomy for Acute Revascularization (STAR) trial and is co-principal investigator of the Endovascular Revascularization With Solitaire Device Versus Best Medical Therapy in Anterior Circulation Stroke Within 8 Hours (REVASCAT) trial. Dr Macho has received consultancy fees from Striker Neurovascular and eV3 (Coviden).

References
15. Mullen MT, Pisapia JM, Tliwa S, Messé SR, Stein SC. Systematic review of outcome after ischemic stroke due to anterior circulation occlusion treated with intravenous, intra-arterial, or combined intravenous+intra-arterial thrombolysis. 
17. IMS II Trial Investigators. The Interventional Management of Stroke (IMS) II Study. 
Stroke. 2010;41:1836–1840.
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on behalf of the Catalan Stroke Code and Reperfusion Consortium

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The online version of this article, along with updated information and services, is located on the World Wide Web at:
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An erratum has been published regarding this article. Please see the attached page for:
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Data Supplement (unedited) at:
http://stroke.ahajournals.org/content/suppl/2014/03/04/STROKEAHA.113.003489.DC1

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The version of the article, “Outcomes of a Contemporary Cohort of 536 Consecutive Patients With Acute Ischemic Stroke Treated With Endovascular Therapy” by Abilleira et al that published online ahead-of-print on March 4, 2014, and appears in the April issue (Stroke. 2014;45:1046–1052) contained an error in the Appendix. Aitziber Aleu was omitted from the list of members of the Catalan Stroke Code and Reperfusion Consortium (Cat-SCR). The authors regret the error.

This correction has been made to the online version of the article, which is available at http://stroke.ahajournals.org/content/45/4/1046.
SUPPLEMENTAL MATERIAL

Outcomes of a Contemporary Cohort Of 536 Consecutive Acute Ischemic Stroke Patients Treated With Endovascular Therapy
SUPPLEMENTAL METHODS

Study design and patient population

The SONIA registry is an ongoing, web-based registry that includes prospective data from all patients undergoing reperfusion therapies for AIS in Catalonia since January 1st, 2011, either systemic, endovascular or both. The present study is based on data from consecutive patients treated with EVT (with or without prior IV rtPA administration) between 01/01/2011 and 11/23/2012, when first patient was randomized into the “Endovascular Revascularization With Solitaire Device Versus Best Medical Therapy in Anterior Circulation Stroke Within 8 Hours” trial (REVASCAT, NCT01692379), an academic trial sponsored by the non-profit foundation Fundació Ictus/Malaltia Vascular (www.fundacioictus.com) and supported by an unrestricted grant from Covidien that involves Comprehensive Stroke Centers (CSC) in Catalonia. Therefore, this study is based on the pre-REVASCAT cohort.

Within the study period, acute stroke care in Catalonia was based on a network of 17 treating hospitals, including 7 Comprehensive Stroke Centers (CSC), 7 Primary Stroke Centers (PSC) and 3 community hospitals operating on a telestroke system. All three levels have capacity to deliver IVT while CSCs perform all EVTs. CSCs share some professional resources (mobile neurointerventional teams) so that every day, 4 CSCs offer a 24-hour service to cover the whole Catalan territory. Furthermore, each CSC has a 24-hour, on-site neurologist who is responsible for pre-alerting the neurointerventional team. This team includes a vascular neurologist who establishes the need of EVT following a common protocol (Supplemental Table I). Briefly, all AIS patients with no contraindication for IVT who arrive within the first 4.5 hours receive the standard dose of rtPA (0.9 mg/kg) at their local centers (either community hospitals through telestroke, PSCs or CSCs). Patients refractory to or ineligible for IVT (including stroke onset beyond 4.5 hours, unknown onset or wake-up stroke) are pre-selected for EVT according to clinical criteria (National Institute of Health Stroke Scale [NIHSS] ≥ 10 or suspicion of large vessel occlusion). Subsequently, at the CSC, EVT indication is based on demonstration of a large vessel occlusion by noninvasive vascular imaging and presence of signs of limited early infarction before transferring the patient to the angiosuite. Multimodal imaging (MRI or CTP) is recommended in patients beyond 4.5 hours from stroke onset. The specific interventional modality (intra-arterial thrombolysis, mechanical thrombectomy, or a combined approach) and application of anesthesia or conscious sedation are up to the interventionalist preference.

Data recorded in the registry

Information contained in the SONIA registry includes baseline clinical and demographic data, clinical and radiological variables at 24-36 hours post-stroke, and the survival and functional status at 3 months. The registry was designed as a simple tool to gather information about EVT based on a reduced core set of clinical and angiographic variables. At baseline, we collect demographic information (age and sex), pre-stroke medical and functional status, clinical data such as time of stroke onset and stroke severity (measured with the National Institute of Health Stroke Scale, NIHSS, obtained by certified neurologists), and specific details on the reperfusion therapy delivered (date/time of treatment, combined IVT + EVT or isolated EVT, mechanical thrombectomy or intra-arterial pharmacological thrombolysis or both, procedure (EVT)
duration, level and degree of arterial occlusion (Thrombolysis in Myocardial Infarction, TIMI), post-procedure modified Thrombolysis In Cerebral Infarction, TICI score). At 24-36 hours, we record the NIHSS, the presence of symptomatic cerebral bleedings (SICH) as defined per the SITS-MOST protocol, and the occurrence of death. At 3 months, the functional status, assessed by the modified Rankin scale (mRS), and the survival are obtained by face-to-face or telephone-based interviews carried out by local certified investigators. Time intervals in this study are defined as follows. The onset-to-groin puncture time (OTP) is defined as time elapsed between stroke onset (last time seen well) and groin puncture. For the subgroup of patients undergoing prior IV rtPA we also defined a needle-to-puncture time (NTP= time delay between IVT initiation and groin puncture). The door-to-puncture time (DTP) is time elapsed between arrival at the CSC and groin puncture, and procedure duration is time elapsed between groin puncture and finalization of the endovascular procedure.

**Definition of patients’ subgroups**

Groups were defined post-hoc according to the following criteria:

1. Age at stroke onset up to 80 years versus patients older than 80 years;
2. Anterior circulation [including occlusions at the following levels: proximal and distal internal carotid artery (ICA), terminal ICA (TICA), tandem occlusions, middle cerebral artery (MCA) and anterior cerebral artery (ACA)] versus posterior circulation strokes [including occlusions of the vertebral arteries (VA), proximal, middle and distal basilar artery (BA), and posterior cerebral arteries (PCA)];
3. Primary EVT [patients undergoing first-choice EVT] versus prior IVT [includes AIS patients treated with IV rtPA followed by EVT];
4. OTP up to 6 hours versus OTP beyond 6 hours;
5. Revascularization (as defined by a modified TICI score 2b-3 at the end of the EVT) versus no revascularization (post-EVT modified TICI score= 0, 1, 2a). Pre-procedure and post-procedure angiograms were evaluated and classified by local investigators in each center and there was no core lab reading.

The SONIIA registry satisfies all legal requirements mandated by the local law of protection of personal data. The study was performed according to local ethical guidelines and with the corresponding patients’ permission for both the endovascular procedure and inclusion of data in the registry.

**Assessment of consecutive inclusion**

To establish completeness of the series, and avoid inclusion bias, the registry includes a close external monitoring that is carried out by members of the Stroke Program, otherwise not involved in stroke routine clinical practice. First, we search for stroke patients treated with EVT throughout the period of interest in the Hospitals Discharge Database based on specific 9th International Classification of Diseases (ICD-9) diagnosis and procedure codes. EVT-treated patients retrieved this way are compared to those included in the registry and undeclared cases (those not included in the SONIIA registry) are further investigated to establish their eligibility (their electronic health records (EHR) checked to ascertain whether or not they underwent EVT for stroke). Confirmed ‘undeclared’ patients are retrospectively included in the registry and together with the prospective inclusions result in the actual sample. After exclusion of patients
undergoing a diagnostic-only angiography and duplicates, the resulting sample was used to calculate outcomes reported in this article (Supplemental Figure I).

**Outcome measures**

This study analyzed clinical outcome variables that had been agreed on pre-hoc by consensus within a reduced group of local stroke leaders. These outcome measures are:

1. SICH rate as defined by the percentage of EVT patients developing a symptomatic cerebral bleeding (SITS-MOST definition) within first 24-36 hours post-procedure.
2. All-cause mortality at 3 months (fatal outcome).
3. Functional independence at 3 months: percentage of EVT patients who achieved functional independence at 3 months post-stroke, as established by a modified Rankin Scale ≤ 2 (good outcome).

At the closing of the database, independent evaluators listed all patients declared lost to follow-up by local collaborators. These patients’ survival status at 90 days post-stroke (and when possible their functional status at 3 months too) was then screened for by searching through their EHR. Patients finally declared lost to follow-up, whose survival status remained unknown after review of their EHR, were assigned the worst possible outcome (death). Patients who were alive at 3 months but with missing mRS values were assigned a 3-month mRS 4-5. Patients with missing SICH information were recoded “SICH positive” if there was neurological worsening at 24-36 hours (NIHSS increase of ≥ 4 points at 24-36 hours).
Supplemental References

Supplemental Table I. Patient selection criteria for endovascular treatment within our regionalized network of CSCs

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Informed consent</td>
</tr>
<tr>
<td>2. Acute ischemic stroke within first 8 hours after symptoms onset (12 hours for posterior circulation strokes or up to 48 hours if symptoms fluctuate and no tetraplegia, or &lt; 6 hours if coma or tetraplegia) refractory to or ineligible for the use of IVT</td>
</tr>
<tr>
<td>3. Wake-up ischemic stroke or unknown ischemic stroke onset</td>
</tr>
<tr>
<td>4. Documented large arterial occlusion in cerebral arteries that correspond to the acute clinical deficit</td>
</tr>
<tr>
<td>5. Age ≤ 85 years</td>
</tr>
<tr>
<td>6. Pre-stroke mRS ≤ 2</td>
</tr>
<tr>
<td>7. Signs of limited early infarction on brain CT (ASPECTS ≥ 7) or MRI (DWI-ASPECTS ≥ 6) and salvageable brain tissue on CT perfusion or MRI-PWI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clinical presentation of intracranial hemorrhage, subarachnoid hemorrhage, arteriovenous malformation, aneurysm or cerebral neoplasm</td>
</tr>
<tr>
<td>2. Rapidly improving neurological symptoms or minor stroke</td>
</tr>
<tr>
<td>3. Comatose patient with NIHSS &gt; 30, except in vertebrobasilar occlusion</td>
</tr>
<tr>
<td>4. Anticoagulation with international normalized ratio &gt; 3 or prolonged partial thromboplastin time that exceeded twice the upper limit of the normal range</td>
</tr>
<tr>
<td>5. Platelet count &lt; 30,000/mm³</td>
</tr>
<tr>
<td>6. Baseline blood glucose concentrations &lt; 50 mg/dl or &gt; 400 mg/dl</td>
</tr>
<tr>
<td>7. Sustained uncontrolled hypertension defined as systolic blood pressure &gt; 185 mm Hg or diastolic blood pressure &gt; 110 mm Hg regardless of intravenous antihypertensive medication</td>
</tr>
<tr>
<td>8. ASPECTS &lt; 7 on CT or &lt; 6 on DWI</td>
</tr>
<tr>
<td>9. Well-developed parenchymal hyperintensity seen on FLAIR or pronounced hypodensity on CT affecting the ischemic region</td>
</tr>
<tr>
<td>10. No evidence of large arterial occlusion on CT-, MR-angiography or transcranial color-coded duplex sonography</td>
</tr>
</tbody>
</table>
### Table II. Baseline clinical and angiographic characteristics of patients undergoing endovascular revascularization and by patients' subgroups

<table>
<thead>
<tr>
<th>Overall EVT cohort</th>
<th>Anterior circulation</th>
<th>Posterior circulation</th>
<th>Prior IV rtPA</th>
<th>Primary EVT</th>
<th>Age ≤80</th>
<th>Age &gt;80</th>
<th>OTP ≤6 h</th>
<th>OTP &gt;6 h</th>
<th>TICI 2b-3 post-EVT</th>
<th>TICI 0-2a post-EVT</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>536 (100)</td>
<td>471 (87.9)</td>
<td>65 (12.1)</td>
<td>285 (53.2)</td>
<td>251 (46.8)</td>
<td>455 (84.9)</td>
<td>81 (15.1)</td>
<td>382 (71.3)</td>
<td>154 (28.7)</td>
<td>396 (73.9)</td>
</tr>
<tr>
<td>Age, mean (SD)</td>
<td>67.5 (13.4)</td>
<td>68.1 (13.2)</td>
<td>63.9 (14.3)</td>
<td>67.3 (13)</td>
<td>67.9 (13.9)</td>
<td>64.8 (12.7)</td>
<td>82.9 (2.3)</td>
<td>68.6 (12.9)</td>
<td>65 (14.2)</td>
<td>67.1 (13.8)</td>
</tr>
<tr>
<td>Sex, male</td>
<td>294 (54.9)</td>
<td>250 (53.1)</td>
<td>44 (67.7)</td>
<td>160 (56.1)</td>
<td>134 (53.4)</td>
<td>266 (58.5)</td>
<td>28 (34.6)</td>
<td>212 (55.5)</td>
<td>82 (53.3)</td>
<td>211 (53.3)</td>
</tr>
<tr>
<td>Prior mRS 0-1</td>
<td>493 (92.0)</td>
<td>435 (92.4)</td>
<td>58 (89.2)</td>
<td>268 (94.0)</td>
<td>225 (89.6)</td>
<td>424 (93.2)</td>
<td>69 (85.2)</td>
<td>348 (91.1)</td>
<td>145 (94.2)</td>
<td>363 (91.7)</td>
</tr>
<tr>
<td>Baseline NIHSS, median (quartiles)</td>
<td>17.5 (13-21)</td>
<td>18 (14-21)</td>
<td>16 (8-27)</td>
<td>17 (14-21)</td>
<td>18 (12-21)</td>
<td>18 (13-21)</td>
<td>19 (15-21)</td>
<td>17 (19-21)</td>
<td>17 (13-21)</td>
<td>18 (14-21)</td>
</tr>
<tr>
<td>Prior IV rtPA</td>
<td>285 (53.2)</td>
<td>261 (55.4)</td>
<td>24 (36.9)</td>
<td>285 (100)</td>
<td>---</td>
<td>243 (53.4)</td>
<td>42 (51.9)</td>
<td>241 (63.1)</td>
<td>44 (28.6)</td>
<td>216 (54.6)</td>
</tr>
<tr>
<td>NTP minutes, median (quartiles)</td>
<td>118 (70-170)</td>
<td>115 (70-175)</td>
<td>179 (95-213)</td>
<td>118 (70)</td>
<td>---</td>
<td>120 (80-140)</td>
<td>110 (65-170)</td>
<td>225 (180-267)</td>
<td>125 (79-195)</td>
<td>115 (70-175)</td>
</tr>
<tr>
<td>DTP minutes, median (quartiles)</td>
<td>115 (75-162)</td>
<td>112 (75-157)</td>
<td>140 (80-190)</td>
<td>---</td>
<td>---</td>
<td>111 (74-155)</td>
<td>117 (78-170)</td>
<td>115 (75-165)</td>
<td>112 (75-160)</td>
<td>113 (73-155)</td>
</tr>
<tr>
<td>Treatment duration minutes, median (quartiles)</td>
<td>95 (60-135)</td>
<td>90 (60-130)</td>
<td>115 (62-190)</td>
<td>---</td>
<td>86 (55-120)</td>
<td>105 (65-145)</td>
<td>97 (60-140)</td>
<td>84 (63-120)</td>
<td>88 (55-120)</td>
<td>80 (50-120)</td>
</tr>
<tr>
<td>Level and Degree of occlusion (pre-procedure)</td>
<td>TMII 0</td>
<td>519 (96.8)</td>
<td>459 (97.5)</td>
<td>60 (92.3)</td>
<td>277 (97.2)</td>
<td>242 (96.4)</td>
<td>441 (96.9)</td>
<td>78 (96.3)</td>
<td>370 (96.9)</td>
<td>149 (96.8)</td>
</tr>
<tr>
<td>TMII 1</td>
<td>12 (2.2)</td>
<td>8 (1.7)</td>
<td>4 (6.2)</td>
<td>6 (2.1)</td>
<td>6 (2.4)</td>
<td>9 (2)</td>
<td>3 (3.7)</td>
<td>7 (1.8)</td>
<td>5 (3.3)</td>
<td>9 (2.3)</td>
</tr>
<tr>
<td>TMII 2</td>
<td>4 (0.9)</td>
<td>2 (0.7)</td>
<td>1 (1.5)</td>
<td>2 (0.7)</td>
<td>8 (1.2)</td>
<td>5 (1.1)</td>
<td>0 (0)</td>
<td>5 (9.1)</td>
<td>1 (1.9)</td>
<td>4 (1.1)</td>
</tr>
<tr>
<td>Anterior circulation</td>
<td>471 (87.9)</td>
<td>471 (100)</td>
<td>---</td>
<td>261 (91.0)</td>
<td>210 (83.7)</td>
<td>395 (86.8)</td>
<td>76 (93.8)</td>
<td>348 (91.1)</td>
<td>123 (79.9)</td>
<td>348 (87.9)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>321 (59.9)</td>
<td>284 (60.3)</td>
<td>37 (56.9)</td>
<td>167 (58.6)</td>
<td>164 (61.4)</td>
<td>258 (56.7)</td>
<td>63 (77.8)</td>
<td>231 (60.5)</td>
<td>90 (58.4)</td>
<td>229 (57.8)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>110 (20.5)</td>
<td>93 (19.8)</td>
<td>17 (26.2)</td>
<td>46 (16.4)</td>
<td>64 (25.5)</td>
<td>90 (19.8)</td>
<td>20 (24.7)</td>
<td>78 (20.4)</td>
<td>32 (20.8)</td>
<td>79 (20)</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>158 (29.5)</td>
<td>145 (30.8)</td>
<td>13 (20)</td>
<td>59 (20.7)</td>
<td>99 (39.4)</td>
<td>123 (27)</td>
<td>35 (43.2)</td>
<td>123 (32.2)</td>
<td>35 (22.7)</td>
<td>124 (31.3)</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>102 (19)</td>
<td>87 (18.5)</td>
<td>15 (23.1)</td>
<td>52 (18.3)</td>
<td>50 (19.9)</td>
<td>97 (21.3)</td>
<td>5 (6.2)</td>
<td>67 (17.5)</td>
<td>35 (22.7)</td>
<td>76 (19.2)</td>
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<tr>
<td>Dyslipidemia</td>
<td>191 (35.6)</td>
<td>169 (35.9)</td>
<td>22 (33.9)</td>
<td>112 (39.3)</td>
<td>79 (31.5)</td>
<td>157 (34.5)</td>
<td>34 (62)</td>
<td>148 (37.7)</td>
<td>47 (30.5)</td>
<td>134 (33.8)</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>69 (12.9)</td>
<td>56 (11.9)</td>
<td>13 (20)</td>
<td>32 (11.2)</td>
<td>37 (14.7)</td>
<td>50 (11)</td>
<td>19 (23.5)</td>
<td>52 (13.6)</td>
<td>17 (11)</td>
<td>52 (13.1)</td>
</tr>
<tr>
<td>Stroke/ TIA</td>
<td>74 (13.8)</td>
<td>58 (12.3)</td>
<td>16 (24.6)</td>
<td>35 (12.3)</td>
<td>39 (15.5)</td>
<td>63 (13.9)</td>
<td>11 (13.6)</td>
<td>53 (13.9)</td>
<td>21 (13.6)</td>
<td>55 (13.9)</td>
</tr>
<tr>
<td>Classification of AIS subtype</td>
<td>Large artery atherosclerosis</td>
<td>116 (23.3)</td>
<td>89 (20.3)</td>
<td>27 (44.3)</td>
<td>64 (24)</td>
<td>52 (22.4)</td>
<td>109 (25.4)</td>
<td>7 (10.1)</td>
<td>75 (21.1)</td>
<td>41 (28.5)</td>
</tr>
<tr>
<td>Cardiogenic</td>
<td>262 (52.5)</td>
<td>239 (54.6)</td>
<td>23 (37.7)</td>
<td>131 (49.1)</td>
<td>131 (56.5)</td>
<td>213 (49.5)</td>
<td>49 (71)</td>
<td>200 (56.3)</td>
<td>62 (43.1)</td>
<td>299 (55.3)</td>
</tr>
<tr>
<td>Undetermined</td>
<td>90 (18.0)</td>
<td>85 (19.4)</td>
<td>5 (8.2)</td>
<td>56 (21.0)</td>
<td>34 (14.7)</td>
<td>77 (18)</td>
<td>13 (18.9)</td>
<td>59 (16.6)</td>
<td>31 (21.6)</td>
<td>66 (17.5)</td>
</tr>
<tr>
<td>Other etiology</td>
<td>31 (6.2)</td>
<td>25 (5.7)</td>
<td>6 (9.8)</td>
<td>16 (6.0)</td>
<td>15 (6.5)</td>
<td>31 (7.2)</td>
<td>0</td>
<td>21 (5.9)</td>
<td>10 (7.0)</td>
<td>22 (5.8)</td>
</tr>
</tbody>
</table>

Data express n (%) unless otherwise stated. Bold numbers indicate p-values < 0.05. NTP: needle-to-puncture; OTP: onset-to-puncture; DTP: door-to-puncture
Supplemental Table III. Final modified TICI scores and occurrence of SICH (SITS-MOST definition) by occlusion level

<table>
<thead>
<tr>
<th></th>
<th>Proximal ICA</th>
<th>Distal ICA + T-ICA</th>
<th>Tandem occlusions</th>
<th>M1</th>
<th>M2</th>
<th>A1</th>
<th>VB system</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>m-TICI 0</td>
<td>8 (25.8)</td>
<td>14 (18.0)</td>
<td>9 (15.8)</td>
<td>27 (10.9)</td>
<td>8 (14.0)</td>
<td>0 (0)</td>
<td>11 (16.9)</td>
<td>77 (14.4)</td>
</tr>
<tr>
<td>m-TICI 1</td>
<td>1 (3.2)</td>
<td>4 (5.1)</td>
<td>1 (1.8)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (3.1)</td>
<td>8 (1.5)</td>
</tr>
<tr>
<td>m-TICI 2a</td>
<td>8 (25.8)</td>
<td>11 (14.0)</td>
<td>6 (10.5)</td>
<td>21 (8.5)</td>
<td>5 (8.8)</td>
<td>0 (0)</td>
<td>4 (6.2)</td>
<td>55 (10.3)</td>
</tr>
<tr>
<td>m-TICI 2b</td>
<td>9 (29.0)</td>
<td>23 (29.5)</td>
<td>22 (38.6)</td>
<td>79 (32.0)</td>
<td>19 (33.3)</td>
<td>0 (0)</td>
<td>14 (21.5)</td>
<td>166 (31.0)</td>
</tr>
<tr>
<td>m-TICI 3</td>
<td>5 (16.1)</td>
<td>26 (33.3)</td>
<td>19 (33.3)</td>
<td>120 (48.6)</td>
<td>25 (43.9)</td>
<td>1 (100)</td>
<td>34 (52.3)</td>
<td>230 (42.9)</td>
</tr>
<tr>
<td>SICH (SITS-MOST definition)</td>
<td>1 (3.2)</td>
<td>8 (10.3)</td>
<td>3 (5.3)</td>
<td>8 (3.2)</td>
<td>5 (8.8)</td>
<td>0 (0)</td>
<td>5 (7.7)</td>
<td>30 (5.6)</td>
</tr>
<tr>
<td>Total</td>
<td>31 (100)</td>
<td>78 (100)</td>
<td>57 (100)</td>
<td>247 (100)</td>
<td>57 (100)</td>
<td>1 (100)</td>
<td>65 (100)</td>
<td>536 (100)</td>
</tr>
</tbody>
</table>

m-TICI: modified TICI scale. Data express n (%).
Supplemental Figure I. Flow diagram of patients in the study including the process of ascertainment of completeness

**Supplemental Figure I Legend:** During the study period, 579 AIS patients undergoing an angiography with the intention to perform an EVT were included in the registry. Of these, 12 cases were detected by the external monitoring process and included retrospectively in the registry. We excluded 2 duplicates and 35 other cases that underwent a diagnostic-only angiography since declaration of such cases was incomplete. The resulting sample contained 32 patients whose 3-month status had been declared lost to follow-up by local investigators. Such cases were further investigated by accessing their Electronic Health Records (EHR). In 6 of 32 cases, all of them foreigners, absence of a health ID card and a fix residence prevented us from obtaining follow-up information or reaching them by phone. Since these cases were considered itinerants, they were finally dropped out. Among the remaining 26, EHR consultation offered information about the survival and functional status at 3 months in 8, the survival status at 3 months only in other 15, and the remaining 3 cases were finally declared lost to follow-up. To note that when 3-month vital/functional situation could not be retrieved, the worst possible situation was assigned.