Intravenous Alteplase for Stroke in Those Older Than 80 Years Old

Gary A. Ford, FRCP; Niaz Ahmed, MD; Elsa Azevedo, MD; Martin Grond, MD; Vincent Larrue, MD; Perttu J. Lindsberg, PhD; Danilo Toni, PhD; Nils Wahlgren, MD

Background and Purpose—Risks and benefits of intravenous thrombolysis for patients with stroke >80 years of age are unclear. We examined outcomes and symptomatic intracerebral hemorrhage rates in ≤80- and >80-year-old patients in the Safe Implementation of Treatment in Stroke International Stroke Thrombolysis Register.

Methods—We compared mortality and independence (modified Rankin Scale 0 to 2) at 3 months and symptomatic intracerebral hemorrhage (per Safe Implementation of Treatment in Stroke ≥4-point deterioration in National Institutes of Health Stroke Scale within 36 hours and Type 2 parenchymal hemorrhage and per National Institute of Neurological Disorders and Stroke [any increase in National Institutes of Health Stroke Scale and any hemorrhage]) of 1831 patients >80 years of age with 19 411 patients ≤80 years of age compliant with other European licensing criteria.

Results—The >80-year-old group (median, 83 years) had more severe strokes (median National Institutes of Health Stroke Scale 14 versus 12), lower levels of prestroke independence (modified Rankin Scale 0 to 1, 82% versus 93%), and a larger proportion of females (59% versus 39%) compared with the younger group (68 years). Symptomatic intracerebral hemorrhage was not significantly increased after adjustment for other risk factors in those >80 years of age compared with those ≤80 years of age (per Safe Implementation of Treatment in Stroke 1.8% versus 1.7%, P=0.70, adjusted OR, 0.90, 95% CI, 0.73 to 1.09; P=0.28; per National Institute of Neurological Disorders and Stroke 9.5% versus 7.8%, P<0.005, adjusted OR, 0.96, 95% CI, 0.87 to 1.06, P=0.42). The patients >80 years of age had a higher mortality rate (30% versus 12%; P<0.005; adjusted OR, 1.53; 95% CI, 1.43 to 1.65; P<0.005) and reduced independence (35% versus 57%; P<0.005; adjusted OR, 0.73; 95% CI, 0.68 to 0.78; P<0.005).

Conclusions—Selected patients with acute ischemic stroke >80 years of age otherwise fulfilling the intravenous alteplase license criteria have a similar rate of symptomatic intracerebral hemorrhage compared with younger patients and are appropriate candidates for thrombolysis. The higher mortality and the poorer functional outcome are consistent with the overall worse prognosis seen in the natural history of this age group. (Stroke. 2010;41:2568-2574.)

Key Words: aging □ elderly □ stroke □ thrombolysis

Thrombolysis for ischemic stroke represents an important therapeutic advance. However, the completed randomized clinical trials of alteplase for ischemic stroke have included very limited numbers of patients aged >80 years. Of the trials included in the individual patient meta-analysis, only the National Institute of Neurological Disorders and Stroke (NINDS) had no age limit of 80 years.¹ The European Cooperative Acute Stroke Study (ECASS) trials specifically excluded this age group.²³ As a consequence, the license for alteplase in the European Union is restricted to patients not >80 years. Data on the safety and efficacy of thrombolysis in the >80 years population are limited, yet given that this age group already accounts for almost one third of stroke admissions in developed countries, reliable data are needed to enable treatment to be offered to appropriately selected older people and improve the very poor outcomes from stroke seen in this group.⁴ Aging demographics and better prevention measures in a middle-aged population are likely to lead to an increasing proportion of admitted patients with patients being >80 years of age. Several small studies have reported outcomes from older patients with stroke treated with thrombolysis. We determined in the very large Safe Implementation of Treatment in Stroke–International Stroke Thrombolysis Register (SITS-ISTR) database the outcomes and complications seen in patients >80 years compared with younger patients.⁵

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Methods

We analyzed data collected in the SITS-ISTR. The methods of data collection have been described in detail elsewhere. Data were collected across 31 countries worldwide from a total of 476 centers. New centers were defined as centers that had not participated in the ECASS I or II studies or did not treat at least 5 patients before joining SITS. Patients with acute ischemic stroke were treated with alteplase according to the provisional European license and local regulatory requirements. Patients who were treated with license protocol violations, other than age >80 years, were excluded from the analysis. The following patients were excluded due to protocol violation. One patient may have >1 exclusion criteria: stroke onset to recombinant tissue plasminogen activator treatment time >3 hours (n=3081), previous stroke within 3 months (n=386), previous stroke earlier than 3 months and history of diabetes mellitus and modified Rankin Scale ≥1 (n=159), anticoagulants with high-dose heparin that alters partial thromboplastin time or oral anticoagulation at stroke onset (n=468), glucose blood pressure treatment <50 or >400 mg/dL (2.7 to 22.2 mmol/L; n=232), baseline National Institutes of Health Stroke Scale (NIHSS) >25 (n=411), systolic blood pressure >185 mm Hg (n=606), diastolic blood pressure >110 mm Hg (n=253), and patients with missing data (n=1454). Patient baseline characteristics, including stroke severity using the NIHSS and prestroke disability and modified Rankin Scale (mRS) score, were recorded. NIHSS was again recorded at 2 and 24 hours after treatment. Outcomes were assessed by 3-month mRS score. All patients underwent brain imaging before treatment and follow-up CT brain imaging was performed at 24 to 36 hours to assess for hemorrhagic transformation. Baseline and follow-up CT scans were reviewed centrally in patients who experienced neurological deterioration or died. Hemorrhagic transformation was categorized using the ECASS trial definitions into hemorrhagic infarction (H1, H2), parenchymal hemorrhage (PH1, PH2), and remote parenchymal hemorrhage (PHr1, PHr2). Symptomatic hemorrhage was defined using both the SITS-MOST2 (≥4-point increase in NIHSS from baseline or death within 36 hours and PH2 or PHr2 hemorrhage) and NIHDS3 (any increase in NIHSS from baseline and any parenchymal intracerebral hemorrhage) definitions. Patients were divided into 2 groups: >80 years and ≤80 years. Baseline characteristics, 90-day mortality, and disability (mRS) and complications were compared between the 2 groups. Because increasing age up to 80 years is known to be associated with an increased risk of intracerebral hemorrhage, in a post hoc analysis, symptomatic intracerebral hemorrhage (SICH) rates, mortality, and disability were determined in the age ranges <60, 61 to 70, 71 to 80, 81 to 90, and >90 years.

Statistical Analysis

Descriptive statistics for the baseline and demographic data are presented according to the 2 groups >80 years and ≤80 years. Unknown values were excluded from the denominator when calculating proportions, as previously described. Multivariable logistic regression analyses were performed in an explorative manner to examine if the outcomes differ between the 2 age groups and to find predictors for the main outcomes in the >80 years group. All variables of interest were included in the analysis. For each main outcome, a backward stepwise procedure was performed using P>0.05 of the likelihood ratio test as rejection. The variables included for each respective outcome were: age group (>80 years and ≤80 years), gender, diabetes mellitus, hyperlipidemia, atrial fibrillation, congestive heart failure, previous stroke, independency before current stroke measured by mRS 0 to 1, smoking, aspirin treatment at stroke onset, baseline NIHSS, baseline blood glucose and blood pressure, body weight, history of hypertension, signs of current infarction in the baseline imaging study, and stroke onset to treatment time. In the univariate analysis, the upper and lower limits of the CIs used a score method with continuity correction for calculation of the 95% CIs of proportions for SICH, mortality, and independence. All analyses were performed using the STATISTICA software Version 8.0. Multiple analyses were performed by generalized linear or nonlinear model and estimation of OR for dichotomized outcome was calculated using a logistic regression analysis.

Results

Patient Characteristics

Baseline patient characteristics are shown in Table 1 for 1831 patients >80 years and 19 411 patients ≤80 years. Patients >80 years had a higher proportion of females; more frequent previous stroke, hypertension, atrial fibrillation, heart failure, and aspirin use on admission; were less likely to be smokers; had higher levels of prestroke disability; increased stroke severity (2-point NIHSS difference); higher systolic blood pressure and blood glucose levels; but had a 5-minute lower median stroke onset to treatment time. The very old group weighed less and received smaller total recombinant tissue...
plasminogen activator doses and were less likely to be treated in new centers. The >80 years group had a greater proportion of strokes due to cardiac source of emboli (49.7% versus 31.6%) consistent with the increased average stroke severity.

Outcomes and Complications
Intracranial bleeding rates as determined by CT or MRI findings in the 2 groups are shown in Table 2. The >80 years group had a slightly greater rate of remote hemorrhage (P = 0.03 for 22- to 36-hour imaging scans and P = 0.04 for any posttreatment scans); otherwise, no significant difference was seen between 2 groups.

Columns 2 to 4 in Table 3 show the unadjusted outcome and symptomatic hemorrhage complications. The >80 years group had an increased 3-month mortality rate compared with the ≤80 years group: 30% versus 12% (P < 0.005), reduced functional independence (mRS 0 to 2) at 3 months: 35% versus 57% (P < 0.005), and a reduced likelihood of complete recovery at 3 months (mRS 0 to 1): 25% versus 40% (P < 0.005). Three-month mRS outcomes, including mortality, are shown in Figure 1. The proportion of patients >80 years surviving with significant disability (mRS 3 to 5) was the same as for a 71- to 80-year-old group (35% versus 33%).

According to the investigator’s judgment, intracerebral hemorrhage was the primary cause of death for 24 of 1831 patients ≤80 years of age and 115 of 7846 (1.5%; P = 0.62) in the 71- to 80-year-old group. Cerebral infarct with hemorrhage was the primary cause of death in 30 of 1831 (1.6%) in those >80 years of age compared with 175 of 19411 (0.9%; P = 0.002) and 97 of 7846 (1.2%; P = 0.17) in those 71 to 80 years of age.

The unadjusted SICH rate did not differ significantly between patients >80 years and those ≤80 years of age with the SITS-MOST (1.8% [1.3% to 2.6%] versus 1.7% [1.5% to 1.9%]) definition but was significantly increased in the >80 years group using the NINDS (9.5 [8.1 to 11.0] versus 7.8 [7.2 to 8.0]) definition. According to the SICH per SITS-MOST definition, 7 of 1768 (0.4%; 95% CI, 0.18 to 0.86) were fatal in >80 years compared with 52 of 19 084 (0.27%; 95% CI, 0.20 to 0.36; P = 0.35) in the ≤80 years group. According to the SICH per NINDS definition, 65 of 1707 (3.8%; 95% CI, 3.0 to 4.9) were fatal in those >80 years compared with 492 of 18 598 (2.7%; 95% CI, 2.4 to 2.9; P = 0.005) in the ≤80 years group.

Because increasing age up to 80 years is known to be associated with an increased risk of intracerebral hemorrhage, SICH rates were determined in the age ranges <60, 61 to 70, 71 to 80, 81 to 90, and >90 years (Figure 2). No significant difference was seen between SICH rates in 81 to 90 year olds compared with 71 to 80 years (P = 0.22 per SITS-MOST definition and P = 0.68 per NINDS definition) and there was no trend toward an increased PH2 or SICH rate in the >90 years group compared with the 71- to 80-year-old group. Mortality and mRS outcomes at 3 months are shown for each age range in Figure 3. There was a progressive increase in mortality and fewer good outcomes with increasing age.

### Table 2. Intracerebral Hemorrhages Detected by CT/MRI Study at Posttreatment Imaging Scans

<table>
<thead>
<tr>
<th></th>
<th>&lt;80 Years</th>
<th>80 Years</th>
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<tbody>
<tr>
<td></td>
<td>(n=1718)</td>
<td>(n=18 630)</td>
</tr>
<tr>
<td>No local hemorrhage</td>
<td>1459 (84.9)</td>
<td>16 025 (86.0)</td>
</tr>
<tr>
<td>HI 1</td>
<td>87 (5.1)</td>
<td>889 (4.8)</td>
</tr>
<tr>
<td>HI 2</td>
<td>61 (3.6)</td>
<td>689 (3.7)</td>
</tr>
<tr>
<td>PH 1</td>
<td>60 (3.5)</td>
<td>511 (2.7)</td>
</tr>
<tr>
<td>PH 2</td>
<td>51 (3.0)</td>
<td>516 (2.8)</td>
</tr>
</tbody>
</table>

Remote Hemorrhages on 22–36 Hours Posttreatment Imaging Scans, No. (%)

<table>
<thead>
<tr>
<th></th>
<th>&lt;80 Years</th>
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<tbody>
<tr>
<td></td>
<td>(n=1717)</td>
<td>(n=18 629)</td>
</tr>
<tr>
<td>No remote hemorrhage</td>
<td>1651 (96.2)</td>
<td>18 116 (97.3)</td>
</tr>
<tr>
<td>Phr 1</td>
<td>45 (2.6)</td>
<td>332 (1.8)</td>
</tr>
<tr>
<td>Phr 2</td>
<td>21 (1.2)</td>
<td>181 (1.0)</td>
</tr>
</tbody>
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P = 0.41 for local hemorrhages for protocol adhered; P = 0.03 for remote hemorrhages for protocol adhered.

### Table 3. Posttreatment Imaging Scans, No. (%)

<table>
<thead>
<tr>
<th></th>
<th>&lt;80 Years</th>
<th>80 Years</th>
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<tbody>
<tr>
<td></td>
<td>(n=1740)</td>
<td>(n=18 880)</td>
</tr>
<tr>
<td>No remote hemorrhage</td>
<td>1668 (95.9)</td>
<td>18 301 (96.9)</td>
</tr>
<tr>
<td>Phr 1</td>
<td>47 (2.7)</td>
<td>362 (1.9)</td>
</tr>
<tr>
<td>Phr 2</td>
<td>25 (1.4)</td>
<td>217 (1.2)</td>
</tr>
</tbody>
</table>

P = 0.81 for local hemorrhages for protocol adhered; P = 0.04 for remote hemorrhages for protocol adhered.

HI 1 indicates hemorrhagic infarct Type 1, small petechiae along the margins of the infarct; HI 2, hemorrhagic infarct Type 2, more confluent petechiae within the infarct area but without space-occupying effect; PH 1, primary intracerebral hemorrhage Type 1, blood clot(s) not exceeding 30% of the infarct area with some mild space-occupying effect; PH 2, primary intracerebral hemorrhage Type 2, blood clots exceeding 30% of the infarct area with significant space-occupying effect; Phr 1, remote primary intracerebral hemorrhage Type 1, small- or medium-sized blood clots located remote from the actual infarct; a mild space-occupying effect could be present; Phr 2, remote primary intracerebral hemorrhage Type 2, large confluent dense blood clots in an area remote from the actual infarct; significant space-occupying effect may be present.

Multivariate analysis was undertaken to compare outcomes and SICH between the 2 groups adjusting for several baseline prognostically important factors as described in the statistical section (columns 5 to 6 in Table 3). After this adjustment, there was no statistically significant difference in SICH rates between patients >80 years and ≤80 years. OR and 95% CIs
in the >80 years group compared with ≤80 years for SICH per SITS-MOST definition was 0.90 (0.73 to 1.09; \( P = 0.28 \)) and for SICH per NINDS definition the OR was 0.96 (0.87 to 1.06; \( P = 0.42 \)). There was a statistically significant difference for mortality and functional independence (mRS 0 to 2) at 3 months between the groups. The OR for mortality in the >80 years group was higher 1.53 (1.43 to 1.65; \( P = 0.005 \)) and for independence was lower 0.73 (0.68 to 0.78; \( P = 0.005 \)). SICH was not related to older age in multivariable analysis taking into account variables listed in the statistical section and that included previously identified potential risk factors for SICH.

Clinical response to alteplase in each group was also examined by comparing changes in NIHSS at baseline, 2 hours, 24 hours, and 7 days between >80-year and ≤80-year groups (Figure 4). The >80 years group had a higher baseline NIHSS score (14 versus 12). Both groups had a similar 3-point improvement in NIHSS at 2 hours. At 24 hours and 7 days, the >80 years had 1 point less improvement in NIHSS (at 24 hours 5 versus 6; at 7 days 7 versus 8). NIHSS scores at baseline, 24 hours, and 7 days differed significantly between >80 and ≤80 years (\( P < 0.005 \) for all time points). Probability values for NIHSS changes from baseline to 2 hours was 0.14 (by analysis of variance test) and \( P = 0.02 \) (by Mann-Whitney U test); from baseline to 24 hour and from baseline to 7 days, the probability values were <0.005 by both methods. The impact of prestroke disability on risk of SICH and 3 months was explored. Prestroke disability (mRS) and SICH per NINDS definition were entered as predictor and their possible interaction for good 3-month outcome (mRS 0 to 2). There was no interaction between these 2 variables with the ≤80 and >80 years groups.

### Discussion

This is the largest prospective observational study of outcomes from thrombolysis in patients >80 of age and contains 4 times the subjects in the meta-analysis of 6 earlier studies. The main finding of this study is that the overall rate of symptomatic and asymptomatic intracerebral hemorrhage was not increased in the >80-year-old group. Although the mortality rate is higher in the >80s compared with younger patients, the proportion of survivors with unfavorable functional outcome (mRS 3 to 5) after thrombolysis was not essentially different between 71- to 80- and 81- to 90-year age bands.

The analysis in 10-year age bands indicates a progressive risk of SICH at each age band between <60 and 80 years with no difference between 71- to 80- and 81- to 90-year age bands using the SITS-MOST definition. Although patients <60 years have a lower risk of SICH than those >70 years, our data do not suggest patients aged 81 to 90 years without major comorbidities have any appreciable increase in the risk of SICH compared with those 71 to 80 years. Data in the >90-year-old group are limited, but the risk of SICH using...
the SITS-MOST definition may be even less in this age group presumably because clinicians are using very tight selection criteria when treating this age group. However, using the NINDS definition, there was a trend to an increased risk in the >90-year-old group. These results are consistent with previous observations in which no differences in SICH rates were reported between patients >80 and ≤80 years.11–13

Comparison of our results with a meta-analysis of 6 studies10 shows very similar outcome for mortality (30% versus 31%) and good outcome mRS of 0 to 1 (25% versus 26%). However, unlike the meta-analysis, we found no increase in SICH for the >80 year olds. Although an increased risk of SICH was reported in the meta-analysis (adjusted OR, 1.22), SICH was defined in different ways in the studies and is difficult to interpret.

The less good outcomes seen with respect to mortality and independence in those >80 years cannot be due to SICH or other complications of thrombolysis, but are due to death from other causes, in particular pneumonia and other complications of stroke. The greater stroke severity, increased prestroke dependency, and frequency of atrial fibrillation and heart failure are factors that contribute to the increased mortality in those >80 years. The mortality rate reported here is consistent with the high mortality rates reported in very old patients with moderately severe strokes not receiving thrombolysis. The Copenhagen Stroke Study reported an in-hospital mortality of 35% in >85 year olds.14

Early changes in NIHSS were similar between >80 and ≤80 year olds suggesting there was no major difference in the recanalization rate in both groups. This is consistent with a study,15 which reported a similar proportion of >80s experienced successful recanalization with intra-arterial therapy.

We undertook multivariable analysis of SICH risk to adjust for the numerous differences in potential confounders at baseline between patients ≤80 years and >80 years. Previous stroke, congestive heart failure, atrial fibrillation, aspirin therapy, high blood pressure, high blood glucose, and severe stroke (NIHSS score) at baseline were more common or higher in patients >80 years compared with younger patients and probably explain the higher SICH rates in the >80-year cohort as defined by NINDS seen in the univariate analysis. The association was not significant after adjustment for these baseline imbalances. Cigarette smoking, which has been found to be negatively associated with the risk of intracerebral hemorrhage in some previous studies was less common among those >80s. Signs of current infarction on baseline imaging, as reported by the treating clinician, were similar in both groups.

The high levels of prestroke complete functional independence (mRS 0 to 1) in the >80 year olds in this cohort suggest significant selection of patients >80 years for treatment. Similar selection processes apply to younger patients, but the prevalence of absolute and relative contraindications to treatment is greater in those >80s. The safety of thrombolysis in patients >80 years who have significant prestroke dependency or do not fulfill the other license criteria is unclear, and the results of this study should not be extrapolated to such groups of patients. However, multivariable analysis of the influence of prestroke functional dependency on SICH found that prestroke mRS of 2 to 5 was not associated with an increased risk of SICH.
We observed a progressive reduction in good outcomes with increasing age, a consistent finding in other studies on outcome in stroke treated with or without thrombolysis.\textsuperscript{10,11} The poor outcome in patients >80 years treated with thrombolysis does not mean thrombolysis is ineffective in this age group. The lack of an increase in SICH in the 81- to 90-year age band suggests thrombolysis is likely to be as clinically effective in >80 year olds in terms of absolute benefits compared with no treatment. However, in clinical practice, the smaller proportion of patients achieving a good outcome in >80 years may lead to clinicians underestimating the benefits in this group and conversely overestimating the benefits of thrombolysis in younger patients.

This study shows the value of prospective Phase IV studies in defining the risks of therapy in those >80 years. The size of the study and broad basis mean the results are robust and reliable and suggest that thrombolysis is an appropriate treatment for carefully selected patients >80 years that can be given without concerns that there is any clinically significant increased risk of SICH. The exact risk benefit of thrombolysis in those >80 can only be determined from randomized trials, but the early improvement in neurological impairment suggests it is likely patients >80 years have a similar extent of successful reperfusion as younger patients. The ongoing Thrombolysis in Elderly Stroke Patients and Third International Stroke Trials will provide more data on the risks and benefits of thrombolysis in a broader range of patients with stroke >80 years in which clinicians remain uncertain whether thrombolysis is indicated.\textsuperscript{16,17}

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Disclosures

N.A. is an employee of SITS International, which received a grant from Boehringer Ingelheim for the SITS-MOST/SITS-ISTR study with alteplase. D.T. has served as a consultant for Boehringer Ingelheim and has been paid lectures fees for attending and speaking at workshops held by Boehringer Ingelheim, Sanofi-Aventis, and Novonordisk. G.A.F. has been paid lecture fees for attending and speaking at workshops held by Boehringer Ingelheim. His institution has received research funding for stroke-related activities from Boehringer Ingelheim and grant assistance toward administrative expenses for coordination of SITS in the United Kingdom. N.W. has received honoraria from Boehringer Ingelheim for educational and consultancy activities. P.L. is supported by the Finnish Academy and Sigrid Juselius Foundation. M.G. has received honoraria from Boehringer Ingelheim for educational and consultancy activities, support for travel to meetings, and funding for a staff member for coordination of SITS in Germany.

References


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Data Supplement (unedited) at:
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In the article entitled “Intravenous Alteplase for Stroke in Those Older Than 80 Years Old” by Ford et al., the online ahead of print version published on 10/7/10 had Dr. Elsa Azevedo’s affiliation listed as “Department of Neurology.” This was corrected to “Stroke Group” for the print and online versions. The authors regret this error.

The corrected version can be viewed online at http://stroke.ahajournals.org/cgi/reprint/41/11/2568.
Abstract 7

80세 초과 뇌졸중 환자에서 정맥내 알테플레이즈

Intravenous Alteplase for Stroke in Those Older Than 80 Years Old

Gary A. Ford, FRCP; Niazi Ahmed, MD; Elsa Azavedo, MD; Martin Grond, MD; Vincent Larrue, MD; Perttu J. Lindsberg, PhD; Danilo Toni, PhD; Nils Wahlgren, MD

(Stroke. 2010;41:2568-2574.)

Key Words: aging ■ elderly ■ stroke ■ thrombolysis

배경과 목적
80세가 넘는 뇌졸중 환자에서 정맥내 혈전응해술(intravenous thrombolysis)의 위험과 효과는 아직 확실하지 않다. 저자들은 뇌졸중 치료의 안전한 적용을 위한 세계 뇌졸중 혈전응해 리뷰스트리SAFE Implementation of Treatment in Stroke International Stroke Thrombolysis Register, SITS-ISTR에서 80세 이하와 80세가 넘는 환자의 예후와 증상성 뇌내출혈(intracerebral hemorrhage)을 조사하였다.

방법

결과
80세 초과군(평균 83세)은 더 젊은 군(68세)에 비해 더 심한 뇌졸중(평균 NIHSS 14 vs. 12), 뇌졸중 전 낮은 독립성 정도(수정랭킨척도 0~1, 82% vs. 93%), 높은 여성 비율(59% vs. 39%)을 보였다. 중상성 뇌내출혈은 80세 이하 환자에 비해 80세 초과 환자에서 다른 위험인자를 보정한 후 의미 있게 높지 않았다(SITS 기준 1.8% vs. 1.7%, P=0.70, 보정한 OR, 0.90 [95% CI, 0.73~1.09; P=0.28], NINDS 기준 9.5% vs. 7.8%, P<0.005, 보정한 OR, 0.96 [95% CI, 0.87~1.06; P=0.42]). 80세 초과 환자들에 더 높은 사망률을 보였으며(30% vs. 12%; P<0.005, 보정한 OR, 1.53 [95% CI, 1.43~1.65, P<0.005] 낮은 독립성(35% vs. 57%; P<0.005, 보정한 OR, 0.73 [95% CI, 0.68~0.78; P<0.005]을 보였다.

결론
80세를 넘지만 다른 정맥내 알테플레이즈(alteplase) 허용 기준을 만족하는 선택된 급성 혈전뇌졸중 환자들은 그보다 젊은 환자와 비교하여 증상성 뇌내출혈의 발생률은 비슷하였고 혈전응해술의 적절한 대상이었다. 더 높은 사망률과 낮은 기능적 예후는 이 연령군의 자연사에서 보이는 전반적으로 낮은 예후와 일치하였다.
### Table 3. Proportion (%) and Adjusted OR of Main Outcomes for Patients >80 Years Compared With ≤80 Years

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Patients &gt;80 Years</th>
<th>Patients ≤80 Years</th>
<th>P</th>
<th>Adjusted OR</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SICH per SITS-MOST</td>
<td>32/1766</td>
<td>316/19,064</td>
<td>0.70</td>
<td>0.90 (0.73–1.09)</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>1.8 (1.26–2.58)</td>
<td>1.7 (1.49–1.85)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SICH per NINDS</td>
<td>162/1707</td>
<td>1407/18,598</td>
<td>0.005</td>
<td>0.96 (0.87–1.06)</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>9.5 (8.18–11.00)</td>
<td>7.8 (7.2–7.96)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality at 3 months</td>
<td>456/1510</td>
<td>2038/16,742</td>
<td>&lt;0.005</td>
<td>1.53 (1.43–1.65)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td></td>
<td>30.2 (27.9–32.6)</td>
<td>12.2 (11.7–12.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence at 3 months</td>
<td>527/1499</td>
<td>9468/16,504</td>
<td>&lt;0.005</td>
<td>0.73 (0.68–0.78)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>(mRS 0–2)</td>
<td>35.2 (32.8–37.7)</td>
<td>57.4 (56.6–58.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete recovery at 3</td>
<td>370/1499</td>
<td>6704/16,504</td>
<td>&lt;0.005</td>
<td>0.81 (0.75–0.87)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>months (mRS 0–1)</td>
<td>24.7 (22.5–27.0)</td>
<td>40.6 (39.9–41.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>