ORIGINAL RESEARCH

Endovascular Treatment of Very Elderly Patients Aged ≥90 With Acute Ischemic Stroke

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***Background*—**Patients aged ≥90 were excluded or under-represented in past thrombectomy trials; thus, uncertainty remains whether treatment benefits can be expected regardless of age. This study investigates outcome and safety of thrombectomy in nonagenarians to improve decision making in a real-world setting.

***Methods and Results*—**All currently available data of patients aged ≥90 enrolled in the GSR-ET (German Stroke Registry–Endovascular Treatment) were combined with a smaller cohort from 3 tertiary stroke centers. Baseline characteristics, procedural (Thrombolysis in Cerebral Infarction scale) and functional outcomes (modified Rankin Scale; mRS), as well as complications (symptomatic intracranial hemorrhage, serious adverse events; SAEs) were analyzed. Good functional outcome was defined as mRS ≤3 at 90-days. 203 patients with anterior circulation stroke and prestroke mRS ≤3 were included. The rate of successful recanalization (Thrombolysis in Cerebral Infarction scale ≥2b) was 75.9% (154/203). Good functional outcome (mRS ≤3) was observed in 21.6% (41 of 193) at 90-days. In-hospital mortality was 27.1% (55 of 203) and increased significantly at 90 days to 48.9% (93 of 190; $P<0.001$). Symptomatic intracranial hemorrhage occurred in 3% (6 of 203) of patients. Logistic regression analysis identified Alberta Stroke Program Early CT Score (adjusted odds ratio, 1.93; 95% CI, 1.01–3.70; $P=0.046$) and initial National Institute of Health Stroke Scale (adjusted odds ratio, 0.85; 95% CI, 0.76–0.97; $P=0.014$) as independent predictors for good outcome. Patients with successful recanalization had a significant ($P=0.001$) shift of mRS distribution with higher rates of good functional outcomes (23.8% [34 of 143] versus 14.9% [7 of 47]) and lower mortality at 90-days (46.8% [67 of 143] versus 55.3% [26 of 47]).

***Conclusions*—**Despite high mortality and less frequent favorable outcome, our data suggest that thrombectomy is still effective and safe for nonagenarians. Decision making for thrombectomy in patients aged ≥90 should be based on a case-by-case basis with regard to initial National Institute of Health Stroke Scale and Alberta Stroke Program Early CT Score. **(*J Am Heart Assoc*. 2020;9: e014447. DOI: 10.1161/JAHA.119.014447.)**

Key Words: elderly • ischemic stroke • nonagenarians • thrombectomy

In past years, mechanical thrombectomy (MT) has demonstrated impressively its efficacy and safety, becoming the first-line therapy for acute ischemic stroke attributed to proximal large vessel occlusions.[1,2] However, some subgroups, including very elderly patients aged ≥90, were excluded or under-represented in past trials. Nevertheless,

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Accompanying Tables S1 and S2 and Figure S1 are available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.119.014447

*A complete list of the GSR-ET Collaborators can be found in the Appendix at the end of the article.

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Received August 27, 2019; accepted January 6, 2020.

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Clinical Perspective

What Is New?

- Mechanical thrombectomy for nonagenarians is safe and effective even though high rates of mortality and less frequent favorable functional outcome can be expected at 90-days follow-up.
- National Institute of Health Stroke Scale and Alberta Stroke Program Early CT Score on admission are independently associated with long-term functional favorable outcome.

What Are the Clinical Implications?

- It is not justified to withhold endovascular therapy options from very elderly patients based on age alone.
- Endovascular treatment decision making for very elderly patients aged ≥90 should be based on a case-by-case basis with regard to comorbidities and stroke severity.

current thrombectomy guidelines consider high age generally not to be a contraindication.[3] Lately, retrospective studies have shown superiority of MT over intravenous thrombolysis alone in octogenarians, but to date only a few case series of nonagenarians undergoing endovascular treatment for large vessel occlusion stroke have been published with mostly inconsistent results.[4–6] Given that age is a strong risk factor for stroke, the demographical prediction of a substantial aging world population will lead inevitably to growing numbers of very elderly patients at risk. Especially, the population aged 80+ in the United States and Europe will more than double in the next decades, defining a healthcare challenge particularly in stroke care.[7,8]

This combined subgroup analysis of the GSR-ET (German Stroke Registry–Endovascular Treatment) aims to investigate outcome and safety of MT for patients aged ≥90 in a large cohort to improve decision making for endovascular therapy in a real-world setting.

Methods

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Study Population

One hundred thirty-nine of all analyzed patients were part of the GSR-ET (July 2015 to April 2018; ClinicalTrials.gov Identifier: NCT03356392). The GSR-ET is an ongoing, open-label, prospective, multicenter registry of 25 sites in Germany collecting consecutive patients undergoing MT. A detailed description of the GSR-ET study design has been published recently.[9] Additionally, 64 cases from 3 high-volume stroke centers (Medical Center Hamburg-Eppendorf, Hospital Bremen-Mitte, and University Hospital Cologne) were included; all of these patients were not part of the GSR cohort, given that they were treated before the start of the GSR-ET (Figure S1). Accordingly, a statistical comparison of both cohorts is provided in Table S1.

The main inclusion criteria for all cases were (1) the diagnosis of an acute ischemic stroke attributed to large vessel occlusion within the anterior circulation, (2) endovascular treatment, (3) patient age ≥90 years at the date of treatment, and (4) a prestroke modified Rankin Scale (mRS) 0 to 3. There were no exclusion criteria regarding additional medical treatment such as intravenous lysis or the choice of thrombectomy devices.

As the leading committee, the ethics committee of the Ludwig-Maximilians University (Munich) approved the GSR-ET as well as the local ethics committees of the participating hospitals gave approval, including all cases from the previous cohort. Accordingly, both ethic committees waived informed consent after review.

Study End Points

The neurological end point was the rate of good functional outcome defined as mRS ≤3 at 90-day follow-up with regard to the included prestroke condition (prestroke mRS ≤3) and patient age. Thirteen patients did not take part in the follow-up program and outcome data were not available retrospectively, and therefore they were excluded from the final functional outcome analysis. The angiographic end point was the successful recanalization (of the occluded target vessel assessed postinterventionally on digital subtraction angiography with the Thrombolysis in Cerebral Infarction [TICI] score ≥2b). Further end points for procedural feasibility and safety included: rates of unsuccessful recanalization with failed arterial groin access; unsuccessful catheter navigation to the occlusion site or failed thrombus passage and recanalization (classified as TICI 0); time from groin puncture to recanalization; and the rate of intervention-related serious adverse events, including iatrogenic dissection, new distal embolization, or occurrence of symptomatic intracranial hemorrhage defined according to the ECASS II (European Cooperative Acute Stroke Study II).[10]

Statistical Analysis

Standard descriptive statistics were used for all presented data. Baseline characteristics were compared by outcome performing Fisher's exact test for categorical variables, Mann–Whitney U test (non-normally distributed data), and the unpaired Student *t* test (normally distributed data) for

continuous variables. The Mann–Whitney U test and McNemar test were performed for comparing outcome follow-up data. Univariable regression was followed by step-wise forward multivariable regression analysis to identify independent predictors for good functional outcomes (mRS ≤3) at 90-day follow-up. Results are presented as odds ratios with 95% CI. Significance level was set at α=0.05. All statistical analyses were carried out using SPSS software (version 22; SPSS, Inc, Chicago, IL).

Results

Two hundred three patients met the inclusion criteria and were treated between January 2013 and April 2018 with MT for anterior circulation stroke. Median age was 92 years (interquartile range [IQR], 90–93), and 77.8% (158 of 203) were women. On hospital admission, median National Institutes of Health Stroke Scale (NIHSS) score was 16 (IQR, 13–20), and median baseline Alberta Stroke Program Early CT Score (ASPECTS) was 9 (IQR, 8–10). Arterial hypertension (84.7%; 172 of 203) and atrial fibrillation (66%; 134 of 203) were the most frequent cardiovascular risk factors. Occlusions were located in the M1 segment (58.1%; 118 of 203) of the middle cerebral artery; the middle cerebral artery M2 segment (15.3%; 31 of 203); and the terminal carotid artery (26.1%; 53 of 203). A total of 58.6% (119 of 203) of all patients received additional intravenous thrombolysis before MT. Thrombectomy was most frequently performed with a stent retriever device (82.3.7%; 167 of 203). Comparison of baseline characteristics on admission showed significant differences in median NIHSS and ASPECTS on admission between functional outcome end points (mRS ≤3 and ≥4) at 90 days (Table 1).

Procedural Outcomes

Median time from onset to groin puncture was 180 minutes (IQR, 146–283). In cases where onset was not documented, median time from last observed well to groin puncture was 353 minutes (IQR, 262–789). In 21.6% (44 of 203) of all cases, MT was performed under conscious sedation. Median time from groin puncture to recanalization was 54.5 (35–87), and a median of 1 (1–2.25) pass was needed for the final thrombectomy result. Successful recanalization (TICI ≥2b) was achieved in 75.9% (154 of 203) of all cases. Unsuccessful recanalization attempts (TICI 0) were reported in 17.7% (36 of 203) of all cases, 5 cases without documentation. Sixty-one percent (19 of 31) of these cases were classified as failed navigation to the thrombus attributed to elongated vessels, and 32.2% (10 of 31) of cases were reported as failed thrombus passage or no recanalization after MT. In 2 cases, no vessel access was established. Reports on periprocedural serious adverse events included 2.5% (5 of 203) of iatrogenic dissections, 2% (4 of 203) of new distal emboli, and 2 cases with small subarachnoid hemorrhage not causing any symptoms. In the comparison of procedural results by functional outcome end points (mRS ≤3 versus ≥4), time from onset to groin puncture (P=0.038), time from groin puncture to recanalization (P=0.006), and number of MT maneuvers (P=0.023) showed significant differences (Table 1).

Functional Outcome

Good functional outcomes (mRS ≤3) were observed in 21.6% (41 of 193) of patients at 90-day follow-up. Figure provides an overview of mRS distribution at 90-days according to final recanalization status. Patients with a TICI ≥2b score had a significant (P=0.001) shift of mRS distribution, with higher rates of good functional outcomes (23.8% [34 of 143] versus 14.9% [7 of 47]) and less mortality at 90 days (46.8% [67 of 143] versus 55.3% [26 of 47]) compared with patients with unsuccessful recanalization (TICI ≤2a). In univariable analysis, initial ASPECTS (P=0.007), NIHSS on admission (P=0.001), time from onset to groin (P=0.036), time from groin puncture to recanalization (P=0.015), and number of MT maneuvers (P=0.026) were predictors for good functional outcome (mRS ≤3) at 90 days. Multivariable analysis confirmed both initial ASPECTS (adjusted odds ratio, 1.93; 95% CI, 1.01–3.70; P=0.046) and NIHSS on admission (adjusted odds ratio, 0.85; 95% CI, 0.76–0.97; P=0.014) as independent predictors for good functional outcome (Table 2). In-hospital mortality was 27.1% (55 of 203) and increased significantly at 90-days to 48.9% (93 of 190; P<0.001). Symptomatic intracranial hemorrhage was observed in 3% (6 of 203) of all cases. There were no differences in outcome parameter regarding patients treated before registry enrollment and those enrolled in the GSR-ET (Table S1).

Discussion

Currently, the HERMES (Highly Effective Reperfusion Evaluated in Multiple Endovascular Stroke Trials) collaborator meta-analysis represents the highest evidence for endovascular treatment of acute ischemic stroke, including a subanalysis of elderly patients. Based on this subanalysis, MT can be considered beneficial for patients aged ≥80 years. However, because of inclusion criteria of the included studies, this subgroup analysis mostly included octogenarians, but numbers of very elderly patients aged ≥90 were beyond statistical significance (0.8%; 5 of 634).[11] Therefore, the conclusion and therapy recommendations derived from HERMES might be only valid for octogenarians, but not necessarily for nonagenarians and centenarians. In our cohort, prevalence of patients aged ≥90 years was higher, suggesting that practice

Table 1. Baseline Characteristics and Procedural Results Compared by Rates of Good Outcome (mRS ≤3) at 90 Days

Baseline Characteristics and Procedural Results	All Patients (n=203)	mRS ≤3 at 90 Days (n=40)	mRS ≥4 at 90 Days (n=150)	*P* Value
Median age, y (IQR)	92 (91–93)	92 (90–93)	92 (91–93)	0.319
Women, % (n)	77.8 (158/203)	77.5 (31/40)	76.7 (115/150)	0.976
Cardiovascular risk factors % (n)				
Hypertension	84.7 (172/203)	82.5 (33/40)	86 (129/150)	0.610
Atrial fibrillation	66 (134/203)	67.5 (27/40)	64.7 (97/150)	0.852
Diabetes mellitus	18.7 (38/203)	15 (6/40)	20 (30/150)	0.650
Hyperlipidemia	25.1 (51/203)	27.5 (11/40)	24.7 (37/150)	0.688
Nicotine	8.9 (18/203)	10 (4/40)	9.3 (14/150)	0.898
Median prestroke mRS (IQR)	1 (0–2)	1 (0–2)	0 (0–2)	0.125
Median NIHSS (IQR)	16 (13–20)	12.5 (8–17)	17 (14–21)	<0.001*
Median ASPECTS	9 (8–10)	10 (8–10)	9 (7–10)	0.005*
Side of occlusions, right % (n)	57.1 (116/203)	67.5 (27/40)	55.3 (83/150)	0.208
Occluded vessel, % (n)				
MCA M1	58.1 (118/203)	60 (24/40)	58.7 (88/150)	
MCA M2	15.8 (32/203)	20 (8/40)	14 (21/150)	
tICA	26.1 (53/203)	20 (8/40)	27.3 (41/150)	
Extracranial ACI stenting	1.9 (4/203)	…	2.4 (4/150)	
IVT % (n)	58.6 (119/203)	52.5 (21/40)	60.7 (91/150)	0.468
Median time from last observed well to groin puncture (min; IQR)	353 (262–789)	393 (241–802)	334 (254–549)	0.647
Median time from onset to groin puncture (min; IQR)	180 (146–283)	162 (135–193)	195 (150–354)	0.038*
Conscious sedation, % (n)	21.7 (44/203)	25 (10/40)	20.7 (31/150)	0.510
Use of stent retriever, % (n)	81.8 (166/203)	80 (32/40)	82 (123/150)	0.819
Median time from groin puncture to recanalization (min; IQR)	54.5 (35–87)	37.5 (25–67)	60 (37–93)	0.006*
No. of MT maneuvers	1 (1–2)	1 (1–2)	2 (1–3)	0.023*
Successful recanalization TICI ≥2b, % (n)	75.9 (154/203)	82.5 (33/40)	73.3 (110/150)	0.304

ASPECTS indicates Alberta Stroke Program Early CT Score; IVT, intravenous thrombolysis; MCA, medial cerebral artery; mRS, modified Rankin Scale; MT, mechanical thrombectomy; NIHSS, National Institute of Health Stroke Scale; tICA, terminal internal cerebral artery; TICI, Thrombolysis in Cerebral Infarction scale.
**P* values indicate statistical significance.

patterns are not entirely reflected by the HERMES cohort and therefore require additional analysis.

In this study only 22.2% (45 of 203) of all treated nonagenarians were men, underlining the facts that women generally have a higher life expectancy and old age is a strong risk factor for stroke.[12,13] Only a few retrospective studies on patients aged ≥90 have been published to date. All studies showed high rates of mortality ranging from 50% to 70%.[5,6,14] Our study confirmed these findings, with 27.1% (55 of 203) of mortality at discharge and significantly ($P<0.001$) increasing numbers 48.9% (93 of 190) at 90-day follow-up. In comparison, large cohorts with younger patients receiving MT showed mortality rates up to 20%.[11,15] This finding emphasizes that very elderly patients are at higher risk of suffering death after endovascular stroke therapy. Additionally, the significant increase of in-hospital to 90-day mortality reveals that nonagenarians are also at higher risk of developing complications after discharge. These outcomes are most likely regardless to initial MT results and possibly related to the well-studied risk factors of age-associated comorbidities in combination with hospitalization leading to higher incidences of lethal complications, such as hospital-acquired infections.[16–18]

In our study, good functional outcome was defined as mRS ≤3 with regard to inclusion criteria (prestroke mRS ≤3). In our opinion, an mRS ≤3 in this very elderly subgroup can be considered a reasonable outcome end point given that mRS 2 and 3 are found to have similar health-related quality-of-life scores, even in younger thrombectomy cohorts.[19] Additionally, numbers of very elderly patients with a prestroke mRS ≤2 are small because of high rates of comorbidities and would possibly describe a biased positive

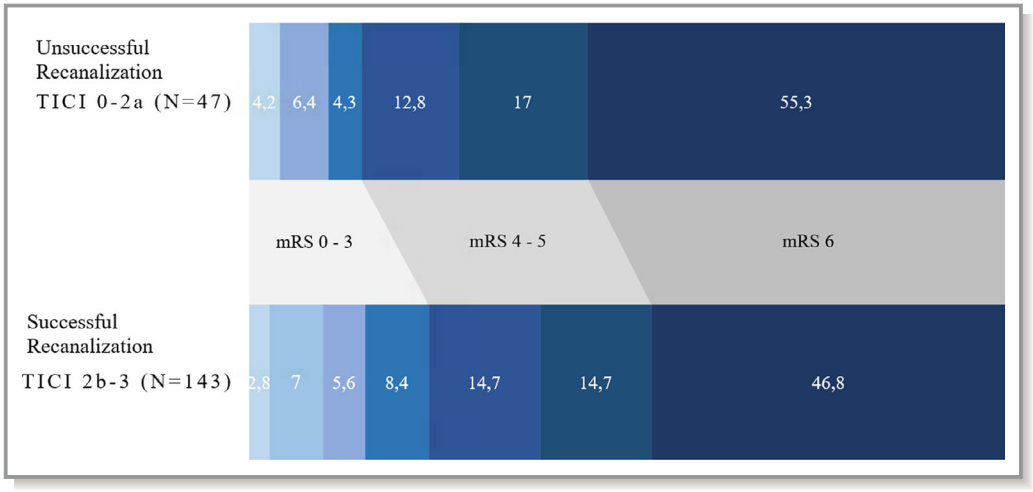

Figure. Distribution of modified Rankin Scale (mRS) scores at 90 days according to recanalization status. TICI indicates thrombolysis in Cerebral Infarction scale.

selection not representing the aimed real-world experience analysis. Good functional outcome of mRS ≤3 at 90-days was observed in 21.6% (41 of 193) lower in our study than in past randomized trials (63%; 399 of 633), confirming that rate of good functional outcome after MT seems to decline with increased age.[20–22] In our statistical analysis, initial ASPECTS and NIHSS on admission were found to be independent predictors for good outcome, emphasizing that decision

Table 2. Logistic Regression Analysis for Predictors of Good Outcome (mRS ≤3) at 90 Days

	OR	95% CI	*P* Value
Univariable analysis			
Age, y	0.91	0.77–1.09	0.334
Sex	0.95	0.41–2.19	0.912
NIHSS on admission	0.89	0.83–0.95	0.001*
ASPECTS	1.53	1.12–2.09	0.007*
IVT	1.32	0.65–2.68	0.441
No. of MT maneuvers	0.69	0.50–0.95	0.026*
Time from onset to groin puncture, min	0.99	0.98–1.00	0.036*
Time from groin puncture to recanalization, min	0.98	0.97–0.99	0.015*
TICI ≥2b	0.58	0.23–1.42	0.236
Multivariable analysis			
Age, y	…	…	NS: 0.270
Sex	…	…	NS: 0.631
NIHSS on admission	0.85	0.71–0.97	0.014*
ASPECTS	1.93	1.01–3.70	0.046*
IVT	…	…	NS: 0.816
No. of MT maneuvers	…	…	NS: 0.513
Time from onset to groin puncture, min			NS: 0.231
Time from groin puncture to recanalization, min	…	…	NS: 0.184
TICI ≥2b	…	…	NS: 0.716

ASPECTS indicates Alberta Stroke Program Early CT Score; IVT, intravenous thrombolysis; mRS, modified Rankin Scale; MT, mechanical thrombectomy; NIHSS, National Institute of Health Stroke Scale; NS, not significant; OR, odds ratio; TICI, Thrombolysis in Cerebral Infarction scale.
**P* values indicate statistical significance.

making for MT in this age group should be done individually considering the severity of stroke.

Successful recanalization (TICI ≥2b) is known to be a predictor for good outcomes after MT, and the latest studies reported on rates of TICI ≥2b up to 95%.[15,23] In our study, TICI ≥2b was achieved in only 75.9% (154 of 203) of cases. The lower success of recanalization in our cohort was attributed to the relatively high number of TICI 0 cases with 17.7% (36 of 203). In most of these cases, the interventionalist reported on failed thrombus access as well as thrombus passage. These findings underline the fact that vessel tortuosity is a well-described difficulty in endovascular therapy with an increased prevalence in the elderly.[4,5,24,25] However, it could also indicate the higher propensity to stop the procedure with a lower number of recanalization attempts. Furthermore, in these frustrating cases, alternative access approaches (eg, transradial or transcarotid) could be of value for this subgroup. Though successful recanalization was not an independent predictor for good outcome (mRS ≤3), mRS scores differed significantly ($P<0.001$) when comparing outcomes at 90-days by recanalization status. In patients with successful recanalization, rates of good functional outcomes (mRS ≤3) were higher (24% versus 15%) and mortality rates lower (47% versus 55%) compared with the unsuccessful recanalization group (Figure). However, the effect of recanalization on 90-day outcome seems to be lower given that more patients in this particular age group worsened regardless of thrombectomy result.

Results on symptomatic intracranial hemorrhage in elderly thrombectomy cohorts are inconsistent, ranging from higher risks to no age relation. With 3% (6 of 203), our results were comparable with recent reports on symptomatic intracranial hemorrhage after thrombectomy. Rates of other complications (iatrogenic dissection, and new distal emboli) in relation to the intervention were in line with the results of previously published randomized studies.[26]

Limitations

Our study has all the limitations that come along with a retrospective design. Furthermore, we are missing a control-arm only treated with intravenous thrombolysis for direct comparison. For further comparison Table S2 provides an overview of the overall GSR-ET cohort[27] and HERMES meta-analysis.[11]

Conclusions

Endovascular treatment for the very elderly aged ≥90 leads to fewer patients with good functional outcomes and higher rates of mortality at 90-days compared with the latest guideline shaping thrombectomy trials. Long-term outcome is predicted by stroke severity (NIHSS and ASPECTS) and recanalization success in combination with age- and hospitalization-associated risk factors defining unique outcome dynamics in this particular population. Though MT for patients aged ≥90 can be challenging, complications do not exceed those of cohorts with younger average patient age published previously. Therefore, it is not justified to withhold endovascular therapy from these patients, but individual decision making should be based on comorbidities, ASPECTS, and stroke severity.

Appendix

GSR-ET Collaborators

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Disclosures

Papanagiotou is a consultant for Penumbra. Fiehler is a consultant for Acandis, Boehringer Ingelheim, Codman, Microvention, Sequent, and Stryker and a speaker for Bayer Healthcare, Bracco, Covidien/ev3, Penumbra, Philips, and Siemens. He has received grants from Bundesministeriums für Wirtschaft und Energie (BMWi), Bundesministerium für Bildung und Forschung (BMBF), Deutsche Forschungsgemeinschaft (DFG), European Union (EU), Covidien, Stryker (THRILL study), and Microvention (ERASER study). Thomalla received personal fees as a consultant or lecturer from Acandis, Bayer, Boehringer Ingelheim, Bristol-Myers Squibb/Pfizer, Daichi Sankyo, and Stryker and research grants from Bayer, Federal

Ministry for Economic Affairs and Energy (BMWi), Corona-Foundation, German Research Foundation (DFG), Else Kröner-Fresenius Foundation, European Union (Horizon 2020), and German Innovation Fund. Mpotsaris is a consultant for Stryker, Penumbra, Perflow, and Phenox. The remaining authors have no disclosures to report.

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Supplemental Material

Table S1. Comparison of cohorts treated before GSR-ET and enrolled in GSR-ET.

Baseline characteristics & outcome parameters	Cases prior to GSR (n=64)	GSR cases (n=139)	*P* Value
Median age (IQR)	92 (90-93)	92 (91-94)	0.104
Women % (n)	76.6 (49/64)	78.4 (109/139)	0.768
Median NIHSS (IQR)	16 (12-20)	17 (14–21)	0.164
Median ASPECTS	9 (8-10)	9 (7–10)	0.135
Occluded vessel % (n)			
- MCA M1	62.5 (40/64)	56.1 (78/139)	
- MCA M2	12.5 (8/64)	17.3 (24/139)	
- tACI	25 (16/64)	26.6 (37/139)	
IVT % (n)	56.3 (36/64)	59.7 (83/139)	0.646
Conscious sedation % (n)	45.3 (29/64)	10.8 (15/139)	<0.001
Successful recanalization	75 (48/64)	78.4 (109/139)	0.221
TICI ≥2b % (n)			
Favorable outcome (mRS≤3)	22.6 (14/62)	19.4 (27/139)	0.984
sICH % (n)	1.6% (1/64)	3.6 (5/139)	0.667
Mortality at 90-days	45.2 (28/62)	52.8 (67/127)	0.644

ASPECTS=Alberta Stroke Program Early CT Score; mRS= modified Rankin Scale; NIHSS = National Institute of Health Stroke Scale; IVT= Intravenous Thrombolysis; MT=Mechanical thrombectomy; MCA=Medial Cerebral Artery; tICA= terminal Internal Cerebral Artery; TICI = Thrombolysis In Cerebral Infarction Scale; sICH= Symptomatic Intracerebral Hemorrhage; GSR-ET= German Stroke Registry-Endovascular Treatment.

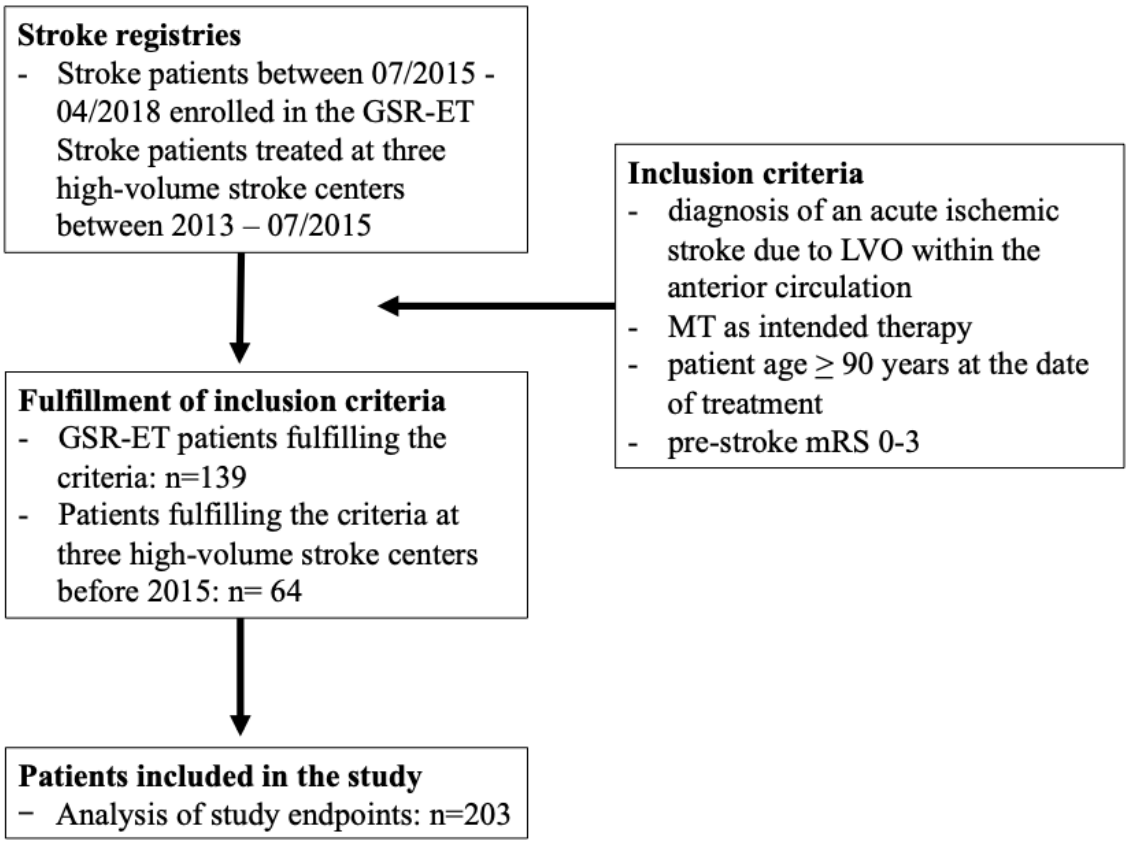
Table S2. Comparison of major baseline characteristics and outcome parameters.

Baseline characteristics & outcome parameters	Present study 90+ (n=203)	Overall GSR cohort[1] (n=2636)	HERMES Meta-analysis[2] (n=634)
Median age (IQR)	92 (91-93)	75 (64–82)	68 (57–77)
Women % (n)	77.8 (158/203)	50.4 (1328/2636)	48 (304/634)
Median NIHSS* (IQR)	16 (13-20)	15 (10–19)	17 (14–20)
Median ASPECTS	9 (8-10)	9 (7–10)	9 (7–10)
Occluded vessel % (n)			
- MCA M1	58.1 (118/203)	53.6 (1374/2565)	69 (439/634)
- MCA M2	15.8 (32/203)	20.1 (516/2565)	8 (51/634)
- tACI	26.1 (53/203)	26.0 (666/2565)	21 (133/634)
IVT % (n)	58.6 (119/203)	56 (1457/2602)	83 (526/634)
General anesthesia % (n)	21.7 (44/203)	66.5 (1674/2518)	-
Successful recanalization	75.9 (154/203)	83 (1857/2236)	71 (402/634)
TICI ≥2b % (n)			
Favorable outcome (mRS≤2)	14.2 (27/190)	36.7 (732/1997)	46 (291/633)
(s)ICH % (n)	3% (6/203)	13.2 (349/2637) †	4.4 (28/634)
Mortality at 90-days	48.9% (93/190)	28.5 (570/1997)	15.3 (97/633)

†Intracranial hemorrhage irrespective of the presence of new clinical symptoms.

ASPECTS=Alberta Stroke Program Early CT Score; mRS= modified Rankin Scale; NIHSS = National Institute of Health Stroke Scale; IVT= Intravenous Thrombolysis; MT=Mechanical thrombectomy; MCA=Medial Cerebral Artery; tICA= terminal Internal Cerebral Artery; TICI = Thrombolysis In Cerebral Infarction Scale; (s)ICH= (Symptomatic) Intracerebral Hemorrhage; GSR-ET= German Stroke Registry-Endovascular Treatment.

Figure S1. Flow chart of patient inclusion.



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