Review Article

Effectiveness and safety of mechanical thrombectomy for acute ischaemic stroke in Latin American countries: A systematic review

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Objective: To describe the use, effectiveness, and safety outcomes of mechanical thrombectomy (MT) for acute ischemic stroke (AIS) in Latin American countries. *Materials and methods:* Studies reporting MT outcomes for AIS in Latin America were identified in CINAHL, MEDLINE, Web of Science, SciELO, EMBASE, and LILACS databases. Synthesis was conducted according to effectiveness (recanalization rates) and safety measures (mortality and functional independence at 90 days). *Results:* Seventeen studies were included, mainly from public and university hospitals. MT utilization varied from 2.6% to 50.1%, while successful recanalization ranged from 63% to 95%. Functional independence 90 days after stroke (a modified Rankin scale score of 0 to 2) was achieved in less than 40% across most studies. Mortality rates were below 30%; studies with posterior circulation strokes reported higher mortality rates. The randomized trial reported better health outcomes for functional independence among patients in the MT group (OR 2.28; 95% CI, 1.41 - 3.69), favoring MT over standard care. *Conclusions:* The included studies had great methodological heterogeneity due to differences in study design, the MT time window, and stroke location. The only randomized trial showed improved functional independence and lower mortality rates with MT than with standard care. The rest of the studies reported similar findings to available literature. Efforts to improve stroke care are reflected in improved patient outcomes in the region. Future studies should consider standard time window criteria and reduce the risk of bias by including representative samples and comparison groups.

Keywords: Systematic review—Mechanical thrombectomy—Stroke—Latin America

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Received October 20, 2022; revision received December 10, 2022; accepted December 24, 2022.

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Grant support: No grant support was received for the development of the present work.

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1052-3057/$ - see front matter

https://doi.org/10.1016/j.jstrokecerebrovasdis.2022.106972

Introduction

Stroke is a leading cause of disability worldwide. According to the Global Burden of Disease study, there has been a 76% increase in the number of new strokes, a 41% increase in stroke-related deaths, and a 34% increase in disability-adjusted life between 1990 and 2017. During the same time period, the number of stroke survivors rose globally by 95%.[1]

Although stroke can be hemorrhagic and ischemic, over two-thirds of all new strokes are indeed attributed to ischaemia.[2] More invasive treatments for acute ischaemic stroke (AIS) have made it possible to significantly extend the treatment time window. For example, intravenous thrombolysis using recombinant tissue plasminogen activator (rt-PA) has a treatment window of 4.5 hours. Mechanical thrombectomy (MT), on the other hand, can increase this window to up to 24 hours. This has increased stroke care access and improved patients' health outcomes.[3,4]

While the number of stroke survivors has increased due to treatment improvements, stroke remains the second highest cause of death in Latin America and the Caribbean, representing 48.21 deaths per 100,000 population.[4,5] Intravenous thrombolysis with rt-PA, the gold standard for AIS, significantly improves functional independence and is widely available in Latin American countries.[6] The accessibility of intravenous rt-PA has increased since its introduction in the region, reaching similar levels to those of higher-income countries with more developed stroke care networks.[7] Nonetheless, the 4.5-hour treatment window remains a significant limitation for patients to benefit from this treatment.[8]

In contrast to rt-PA, MT is not widely accessible in Latin America. According to Martins et al., only ten (Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Guatemala, Mexico, Panama, and Uruguay) out of the 13 countries reporting data on MT stated that this treatment method was even available at all. Of those ten countries, only four (Brazil, Chile, Costa Rica and Panama) stated that MT was administered in public hospitals. This limits invasive stroke care access to private healthcare institutions in most countries, creating further inequalities in terms of treatment options.[9]

Despite the limited availability of MT in Latin America, studies from countries that use it have reported similar safety outcomes and levels of effectiveness to those of large, multicentric randomized trials. For instance, Beckhauser et al described the outcomes of 54 Latin American MT patients three months after hospital discharge. This group was found to display comparable recanalization, functional independence, and mortality rates to those of the DAWN and DEFUSE 3 trials, two of the most significant trials in the field to date.[10] Similarly, a study conducted by Rivera et al across public hospitals in Chile displayed similar safety and effectiveness outcomes to five large trials (MR CLEAN, ESCAPE, REVASCAT, SWIFT PRIME, and EXTEND IA).[11]

Despite this promising data, there has not been a systematic evaluation of MT effectiveness and safety outcome in studies in the Latin America region. Therefore, this study aims to describe the use, effectiveness, and safety of MT in patients with acute ischemic stroke in Latin America through a systematic review of the literature.

Methods

The protocol of the present study can be found at[12]. The PROSPERO registration form is CRD42021231004.

Eligibility criteria

Eligible studies were randomized controlled trials, non-randomized controlled trials (RCTs), observational studies, and primary studies of any systematic review identified. The articles should also have reported original data on MT's effectiveness and safety. The participants of the included studies must have been adult patients (≥18 years) with AIS defined by neuroimaging (computed tomography or magnetic resonance imaging).[13] Studies addressing other types of strokes (hemorrhagic or transient ischemic attack) were excluded. The intervention evaluated must have been MT with or without concomitant IV thrombolysis. The initial comparison group was originally to have been patients with no form of endovascular treatment; however, due to the scarcity of studies including a comparison group, the authors agreed to extend the inclusion criteria to studies without a comparison group.

Included studies must have been developed in Latin American countries; including North and Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama), South America (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela), and the Caribbean (Cuba, Dominican Republic, Haiti, Guadeloupe, Martinique, Puerto Rico, Saint-Barthélemy, Saint-Martin).

Information sources

Studies were identified by searching the CINAHL, MEDLINE, Web of Science, SciELO, EMBASE, and LILACS databases. Grey literature sources (OpenGrey, Database of abstracts of reviews and effects) and clinical trials registries (ClinicalTrials.gov, ISRCTN registry, and World Health Organization International Clinical Trials Registry Platform) were also consulted to identify studies not indexed in the searched databases. Additional search strategies included citation tracking using Google Scholar and Web of Science, as well as reference list checks of the included articles.

Table 1. *Primary outcomes evaluated in the included studies.*

Outcome	Definition
MT utilization rate	The number of stroke patients receiving mechanical thrombectomy over the total number of patients admitted during the study period.[14]
Effectiveness	a The proportion of patients with favorable outcomes (0-2) at 90 days after hospital discharge was measured using the modified Rankin scale (mRs).[15] b Percentage of successful recanalization after mechanical thrombectomy (defined as thrombolysis in cerebral infarction (TICI) score of 2b-3).[16]
Safety Outcomes	a The proportion of symptomatic or asymptomatic intracranial hemorrhage.[17] b All-cause mortality at 90 days.[18]

MT approval by the American Stroke Association, a reference in most Latin American countries, was published in 2015.[4] Thus, the literature search was limited to papers published from 2015 onwards. Studies published in English, Spanish, or Portuguese were considered. The last search for this review was conducted on 28 February 2021.

Search strategy, selection, and data collection process

A combination of the terms (cerebrovascular disease OR stroke) with (mechanical thrombolysis OR thrombectomy OR endovascular procedure*) was used for the search strategy. All terms were searched employing controlled vocabulary (i.e., Medical Subjects Headings [MeSH]). A sample of the search strategy can be found in **Supplementary material 1**.

Two review authors conducted the selection process (AGA, ACP). Firstly, the reviewers independently screened titles and abstracts to identify studies for potential inclusion. Secondly, the full text of studies meeting the eligibility criteria was retrieved to assess the article for final inclusion. Thirdly, after agreeing on the articles' final inclusion, two authors (AGA, ACCP) independently extracted data using a predefined data extraction form template (available upon request) adapted from the EPOC Cochrane group. In the case of disagreements, an additional step was added to solve these by consensus or by a third author (FGR).

Outcomes and risk of bias

The primary outcomes evaluated in this study are presented in Table 1. Additional outcomes were patients' characteristics (i.e., age, sex) and stroke severity at hospital admission measured by the National Institutes of Health Stroke Scale (NIHSS). The stroke care setting was obtained from the information in the article (i.e., author's affiliation) or the institution's official website.

The Newcastle-Ottawa Scale and the Risk of Bias 2 (ROB-2) were used for non-randomized and randomized trials to evaluate the risk of bias in the included studies.[19,20] The Newcastle-Ottawa scores were classified as good quality if the article had three or four stars in the selection domain, one or two stars in the comparability domain, and two or three stars in the outcome/exposure domain. The scores were classed as fair quality if the article had two stars in the selection domain, one or two stars in the comparability domain, and two or three stars in the outcome/exposure domain. Finally, the scores were classed as poor quality if the article had zero or one star in the selection domain, or zero stars in the comparability domain, or zero or one star in the outcome/exposure domain.[21] Two authors (AGA, ACCP) independently rated the quality of reporting.

Data synthesis and confidence in cumulative evidence

Due to the heterogeneity in the study design, a meta-analysis was not appropriate. Therefore, a narrative synthesis was conducted following the synthesis without meta-analysis (SWIM) guidelines.[22] The synthesis was performed around (i) the findings of the included studies based on the primary outcomes of this review (Table 1), and (ii) the quality of the included studies.

Results

Study selection

Only 17 studies were included after the identification and screening process (Figure 1). The main reasons for exclusion were not reporting the pre-specified outcomes and not conducting the study in Latin American countries. Two studies were identified through citation searching, and only one was included after being assessed for eligibility.[23]

Study characteristics

Only six countries were represented in the included articles: Argentina, Brazil, Chile, Ecuador, Mexico, and Puerto Rico. Most of the studies were conducted in public or University hospitals, with only two performed in private hospitals.[24,25] The average duration of studies was

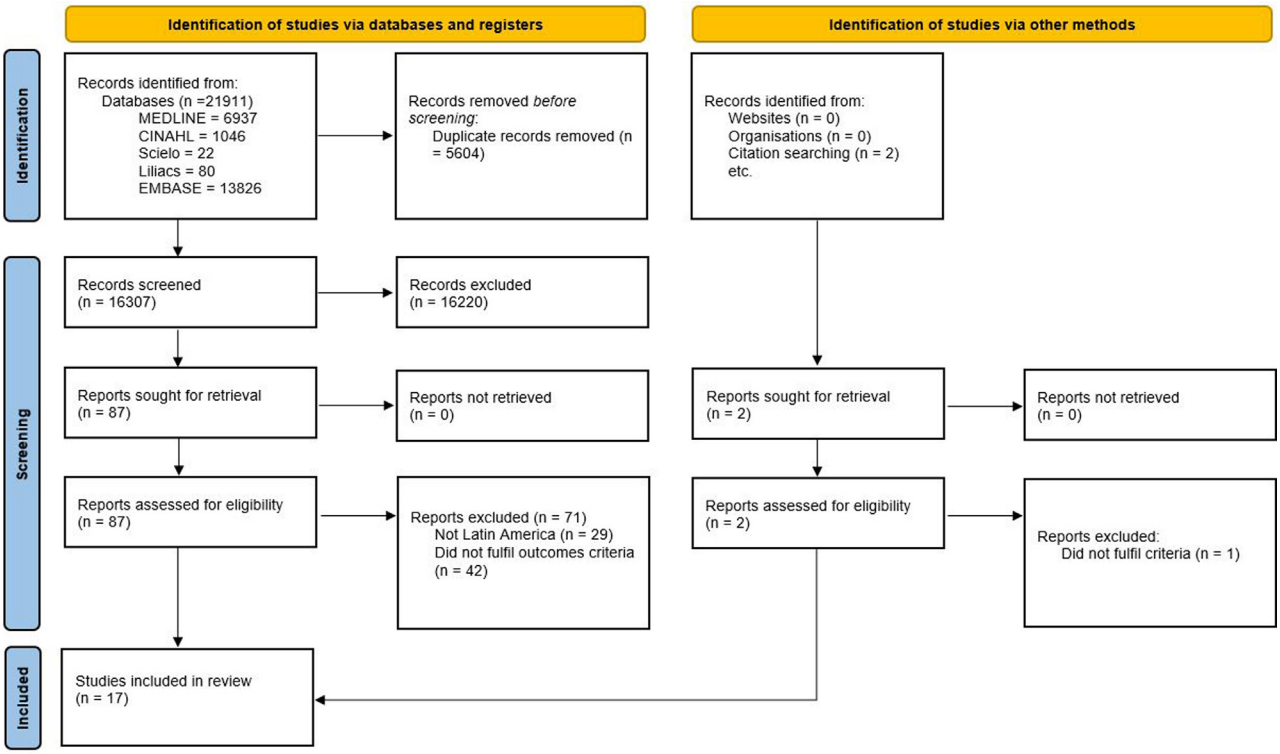

Fig. 1. *Flow diagram of included studies.*

51.4 ± 26.65 months. Of the 17 studies, nine (52.94%) were case series, seven were cohort studies (41.18%), and only one was a randomized trial. A summary of the studies' characteristics and findings is presented in Table 2.

The MT utilization rate was calculated in seven studies. Colla-Machado et al. reported the lowest rate, with only 2.6% of all evaluated patients receiving MT. Dias et al. reported the highest, with 50.1%.[26,27]. The recanalization rate following treatment with MT varied between 63.7% and 95%, as reported by Reyes et al. and Rivera et al. respectively.[11,28] Most of the studies reported a modified Rankin score (mRs) below three in less than 40% of the followed-up patients. The exceptions were Alet et al. (67%), Cabral et al. (55%), and Cirio et al. (47.5%).[24,29,30] The randomized trial by Martins et al. reported a positive odds ratio (OR) of mRS at 90 days of 2.28 (95% CI, 1.41 - 3.69). This indicated the favoring MT over standard care.[23]

The rate of intracranial hemorrhage also differed in the included studies. Some reported asymptomatic hemorrhage, while others had symptomatic hemorrhage. Among those reporting asymptomatic hemorrhage, rates varied between 3.7% and 45.5%.[26,27] However, the rates of symptomatic hemorrhage remained below 10% in all studies with this outcome, ranging from 4.1% to 8.7%.[25,31] Mortality rates 90 days after the procedure remained below 30% in most studies, with only three reporting rates above 30%. However, these three studies involved patients with posterior occlusions.[27,31,32]

Risk of bias

Table 3 summarizes the results of the risk of bias assessment. Most of the studies (87.5%) were classified as poor quality, with only two classified as good quality.[24,32] Most studies failed to recruit a representative population sample, while only two included comparison groups. Cabral et al.[24] included an intravenous thrombolysis group to compare against patients receiving MT, while Dias et al.[32] included both a conservative treatment group and an intravenous thrombolysis group. All but two studies showed good performance in the measurement of outcomes.[25,33] Only the study by Martins et al. was evaluated using the Rob-2 scale, obtaining a low risk of bias in each of the five domains and the overall score (**Supplementary material 2**).[23]

Discussion

This study examined the literature on MT for ischaemic stroke in Latin American countries. The findings on the review's three main outcomes (MT rate, effectiveness, and safety) were consistent among the included studies despite the heterogeneity of the study design. The lack of a representative sample and comparison groups compromised the quality of the studies and increased the risk of bias, with the exception of the only randomized trial that showed an overall low risk of bias.

Table 2. *Summary of findings of the included studies.*

Author, year	City, country	Stroke care setting	Study design	Patients receiving MT	Window period and MT criteria	Outcomes		
						MT utilization rate	Effectiveness	Safety
Alet, 2020[29]	Buenos Aires, Argentina	Public hospital, stroke care unit	Cohort	**Age:** 66 ± 14.5 **Sex, males:** 15 (56%) **NIHSS:** 20 (14, 24)	• **Window period:** up to 6 h • **Affected circulation:** anterior and posterior • **Number of patients with posterior stroke receiving MT:** 2 (7%)	27 (3%)	**Recanalization rate:** 21 (78%) **mRS < 3 at 90 days:** 18 (67%)	**Intracranial hemorrhage*:** 8% **Mortality at 90 days:** 3 (11%)
Achi-Arteaga, 2015[34]	Guayaquil, Ecuador	NS	Case series	**Age:** NS **Sex, males:** NS **NIHSS:** NS	• **Window period:** up to 8 h for anterior stroke, up to 12 h for posterior strokes • **Affected circulation:** anterior and posterior • **Number of patients with posterior stroke receiving MT:** 1 (11%)	Not applicable due to study design	**Recanalization rate:** 8 (89%) **mRS < 3 at 90 days:** NS	**Intracranial hemorrhage:** 1 (11%) **Mortality at 90 days:** NS
Beckhauser, 2020[10]	Sao Paolo, Brazil	Public university hospital, stroke care unit	Cohort	**Age:** 65.6 ± 16.1 **Sex, males:** 30 (55.6%) **NIHSS:** 17 (13, 21)	• **Window period:** > 6 h • **Affected circulation:** anterior • **Number of patients with posterior stroke receiving MT:** 18 (%)	208 (11.96%)	**Recanalization rate:** 50 (92.6%) **mRS < 3 at 90 days:** 18 (34%)	**Intracranial hemorrhage:** 6 (11%) **Mortality at 90 days:** 11 (20.3%)
Cabral. 2016[24]	Joinville, Brazil	1 public and 1 private hospital, stroke care unit	Case series	**Age:** 61.7 ± 11.6 **Sex, males:** 19 (61.3%) **NIHSS:** 19 (17, 24)	• **Window period:** up to 6 h • **Affected circulation:** anterior and posterior • **Number of patients with posterior stroke receiving MT:** 5 (16%)	Not applicable due to study design	**Recanalization rate:** 22 (71%) **mRS < 3 at 90 days:** 17 (54.8%)	**Intracranial hemorrhage:** 3 (9.7%) **Mortality at 90 days:** 8 (26%)

Table 2 (*Continued*)

Author, year	City, country	Stroke care setting	Study design	Patients receiving MT	Window period and MT criteria	Outcomes		
						MT utilization rate	Effectiveness	Safety
Cirio, 2020[30]	Buenos Aires, Argentina	NS	Cohort	**Age:** 67.5 ± 15 **Sex, females:** 72 (51.8%) **NIHSS:** 14 (8, 18)	• **Window period:** up to 24 h • **Affected circulation:** anterior **number of patients with posterior stroke receiving MT:** NA	139 (19.89%)	**Recanalization rate:** 104 (74.8%) **mRS < 3 at 90 days:** 66 (47.5%)	**Intracranial hemorrhage*:** 11 (7.9%) **Mortality at 90 days:** 26 (18.7%)
Colla-Machado, 2016[26]	Buenos Aires, Argentina	University Hospital, NS	Cohort	**Age:** 64 ± 21 **Sex, females:** 6 (55%) **NIHSS:** 19 ± 6	• **Window period:** up to 6 h • **Affected circulation:** anterior and posterior • **Number of patients with posterior stroke receiving MT:** 2 (18%)	11 (2.6%)	**Recanalization rate:** 8 (73%) **mRS < 3 at 90 days:** 3 (27.3%)	**Intracranial hemorrhage:** 5 (45.5%) **Mortality at 90 days:** 3 (27.3%)
Dias, 2017[32]	Ribeirao Prieto, Brazil	University hospital, stroke care unit	Cohort	**Age:** 65 ± 9 **Sex, females:** 16 (84%) **NIHSS:** 29 (15, 33)	• **Window period:** up to 9 h • **Affected circulation:** posterior	19 (30.16%)	**Recanalization rate:** 15 (79%) **mRS < 3 at 90 days:** 6 (31%)	**Intracranial hemorrhage:** 1 (6.6%) **Mortality at 90 days:** 8 (42%)
Dias, 2019[27]	Ribeirao Prieto, Brazil	University hospital, stroke care unit	Cohort	**Age:** 65 ± 9 **Sex, males:** 23 (92%) **NIHSS:** 26 (15, 32)	• **Window period:** up to 48 h • **Affected circulation:** posterior	27 (50.1%)	**Recanalization rate:** 85% **mRS < 3 at 90 days:** 10 (36%)	**Intracranial hemorrhage:** 1 (3.7%) **Mortality at 90 days:** 10 (37%)
Gatto, 2017[33]	Curitiba, Brazil	University Hospital, NS	Case series	**Age:** 57 ± 16.53 **Sex, females:** 22 (54%) **NIHSS**:** 14 (range 6 − 20)	• **Window period:** up to 8 h • **Affected circulation:** anterior and posterior • **Number of patients with posterior stroke receiving MT:** 11 (22%)	Not applicable due to study design	**Recanalization rate:** 29 (70.4%) **mRS < 3 at 90 days:** NA	**Intracranial hemorrhage:** 7 (17%) **Mortality at 90 days:** NA

Table 2 (*Continued*)

Author, year	City, country	Stroke care setting	Study design	Patients receiving MT	Window period and MT criteria	Outcomes		
						MT utilization rate	Effectiveness	Safety
Gonzalez-Villaman, 2015[35]	San Juan, Puerto Rico	NS	Case series	**Age:** 57 **Sex, females:** NS **NIHSS:** NS	• **Window period:** NS • **Affected circulation:** anterior • **Number of patients with posterior stroke receiving MT:** NA	Not applicable due to study design	**Recanalization rate:** 9 (90%) **mRS < 3 at 90 days:** NA	**Intracranial hemorrhage:** 2 (20%) **Mortality at 90 days:** NS
Lucena. 2016[36]	Ribeirao Prieto, Brazil	University Hospital, NS	Case series	**Age:** 67.1 ± 11.43 **Sex, males:** 14 (70%) **NIHSS:** 16 (IQR 9.8)	• **Window period:** NS • **Affected circulation:** anterior • **Number of patients with posterior stroke receiving MT:** NA	Not applicable due to study design	**Recanalization rate:** 18 (90%) **mRS < 3 at 90 days:** 7 (35%)	**Intracranial hemorrhage*:** 1 (5%) **Mortality at 90 days:** 4 (20%)
Martins, 2020[23]	Multiple sites, Brazil	Public hospitals, N	Randomized trial	**Age:** 65 (54, 77) **Sex, females:** 51 (45.9%) **NIHSS:** 18 (14, 21)	• **Window period:** up to 8 h • **Affected circulation:** anterior **number of patients with posterior stroke receiving MT:** NA	Not applicable due to study design	**Recanalization rate:** 91 (82%) **mRS < 3 at 90 days:** 39 (35.1%)	**Intracranial hemorrhage*:** 5 (4.5%) **Mortality at 90 days:** 27 (24.3%)
Marquez-Romero, 2020[37]	9 cities, Mexico	Government-funded academic and private hospitals, NS	Case series	**Age:** 65.1 ± 14.6 **Sex, females:** 28 (57.1%) **NIHSS:** 16 (IQR 6)	• **Window period:** NS • **Affected circulation:** anterior and posterior • **Number of patients with posterior stroke receiving MT:** 2 (%)	Not applicable due to study design	**Recanalization rate:** 34 (69.4%) **mRS < 3 at 90 days:** NA	**Intracranial hemorrhage*:** 2 (4.1%) **Mortality at 90 days:** NA
Nakiri, 2017[38]	Ribeirao Prieto, Brazil	University hospital, stroke care unit	Case series	**Age:** 65 ± 14 **Sex, males:** 91 (57.76%) **NIHSS:** 19 (15, 24)	• **Window period:** up to 6 h • **Affected circulation:** anterior and posterior • **Number of patients with posterior stroke receiving MT:** (16%)	Not applicable due to study design	**Recanalization rate:** 120 (76%) **mRS < 3 at 90 days:** 58 (36%)	**Intracranial hemorrhage*:** 11 (6.8%) **Mortality at 90 days:** 37 (23%)

Table 2 (*Continued*)

Author, year	City, country	Stroke care setting	Study design	Patients receiving MT	Window period and MT criteria	Outcomes		
						MT utilization rate	Effectiveness	Safety
Pazuello, 2020[31]	Ribeirao Prieto, Brazil	Public, NS	Case series	**Age:** 67 ± 12.8 **Sex, males:** 56 (70%) **NIHSS:** 22.4 (1, 38)	• **Window period:** up to 24 h • **Affected circulation:** posterior	Not applicable due to study design	**Recanalization rate:** 69 (86.2%) **mRS < 3 at 90 days:** 21 (26.2%)	**Intracranial hemorrhage*:** 7 (8.7%) **Mortality at 90 days:** 31 (38.7%)
Reyes, 2018[28]	Santiago, Chile	Public, NS	Cohort	**Age:** 61.1 ± 15.8 **Sex, males:** 56 (53.8%) **NIHSS:** 12 (5, 18)	• **Window period:** up to 12 h • **Affected circulation:** anterior and posterior • **Number of patients with posterior stroke receiving MT:** 21 (20.1%)	104 (5.5%)	**Recanalization rate:** 60 (63.7%) **mRS < 3 at 90 days:** NA	**Intracranial hemorrhage*:** 6 (5.76%) **Mortality at 90 days:** NA
Rivera, 2020[11]	Santiago, Chile	Public hospitals, stroke care unit	Case series	**Age:** 62.8 ± 11.8 **Sex, males:** 56 (56%) **NIHSS:** 17 (11, 20)	• **Window period:** up to 6 h • **Affected circulation:** anterior **number of patients with posterior stroke receiving MT:** NA	Not applicable due to study design	**Recanalization rate:** 95 (95%) **mRS < 3 at 90 days:** 38 (38%)	**Intracranial hemorrhage*:** 5 (5%) **Mortality at 90 days:** 11 (11%)

*Symptomatic intracranial hemorrhage.
**Data is only available for nine patients. NA: not available, NS: not specified.

Table 3. *Results of the risk of bias assessment of non-randomized trials.*

Author (year)	Selection	Comparability	Outcome	Overall
Achi-Arteaga (2015)	★	-	★★	Poor quality
Alet (2020)	★★	-	★★★	Poor quality
Beckhauser (2020)	★★	-	★★★	Poor quality
Cabral (2016)	★★★★	★	★★★	Good quality
Cirio (2020)	★★	-	★★★	Poor quality
Colla-Machado (2016)	★★	-	★★★	Poor quality
Dias (2017)	★★★	★	★★★	Good quality
Dias (2019)	★★	-	★★★	Poor quality
Gatto (2017)	-	-	★	Poor quality
Gonzalez-Villaman (2015)	-	-	-	Poor quality
Lucena (2016)	★★	-	★★★	Poor quality
Marquez-Romero (2020)	★★	-	★	Poor quality
Nakiri (2017)	★★	-	★★★	Poor quality
Pazuello (2020)	★★	-	★★★	Poor quality
Reyes (2018)	★	-	-	Poor quality
Rivera (2020)	★★	-	★★	Poor quality

Although our study found reports from only six countries, data from ministries of health and stroke experts from Latin America published by Martins et al. showed that mechanical thrombectomy is indeed performed in over ten countries across the region.[39] Data from the six countries represented in our study was mainly from public or university hospitals. This could also influence the health outcomes, as it has been described that patients receiving care in private settings report better outcomes than those in public hospitals.[40] Inequality also exists between patients in urban and rural areas. Patients from rural areas face additional barriers in accessing stroke care, which is something that was further exacerbated by the COVID-19 pandemic.[41] As a consequence of these factors, there have been significant efforts in Latin America to improve access to intravenous rt-PA and mechanical thrombectomy to public hospitals and rural communities. The Declaration of Gramado was established in 2018, which included commitments to increase stroke care training, implement national stroke care policies, and standardize evidence-based stroke care.[39]

The number of patients receiving MT varied considerably across the studies (mainly due to time window differences), but was higher than in other recent reports. Take, for instance, a study from the Ibero-American Stroke Organization (SIECV, *Sociedad Iberoamericana de Enfermedades Cerebrovasculares*) and the Safe Implementation of Treatments in Stroke (SITS). This study comprised 58 centers distributed in 14 Latin American countries and reported that less than one percent of stroke patients were treated with MT.[7] However, it must be noted that this information was collected from 2009 to 2013, before the inclusion of MT in the acute stroke care guidelines in 2015.

Another recent study compared the effect of the COVID-19 pandemic on stroke care in 18 centers across seven Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Paraguay, and Peru). This study reported a higher MT rate, with 4.3% of the patients receiving MT in the pre-pandemic setting.[42] Although MT rates were above 4.3% in most studies, it must be acknowledged that differences in selection criteria and the poor quality of study designs present significant limitations in determining an accurate MT rate. Only 10% of patients with acute ischaemic stroke are estimated to be eligible for MT[43], as shown by population-based studies reporting that 12% of stroke patients receive this treatment.[44]

Effectiveness outcomes were consistent among our findings. They resembled those from a systematic review and meta-analysis by Hui et al., which reported a pooled rate of successful recanalization of 75% (95% CI, 65% – 83%).[45] Furthermore, the OR favoring mechanical thrombectomy over standard care in this meta-analysis was 2.07 (95% CI, 1.61−2.66), which is similar to the only randomized trial in our review.[45, 23] Despite the inconsistencies in reporting intracranial hemorrhage (symptomatic vs. asymptomatic), the studies included in this review showed similar rates to those from large cohorts. For example, the Endovascular Treatment for Acute Anterior Circulation Ischemic Stroke Registry in China reported symptomatic ICH in 13.8%[46], which is higher than the studies included in our review. Similarly, a 612-patient MT study conducted in a German tertiary university hospital reported an overall ICH of 31.9%, with only 4.4% being symptomatic.[47] The mortality rates at 90 days remained below 30% in patients with anterior circulation occlusions, but were higher than a pooled mortality rate (15%; 95% CI 12% - 19%) from a meta-analysis of 2460 patients.[48]

Although the data to attribute higher mortality rates to a specific factor is limited due to the methodological

design and poor quality of the studies, evidence does show that the inequalities regarding access to care in public hospitals do indeed influence health outcomes. This is demonstrated by a Mexican national registry, which recorded that patients treated in private hospitals reported better functional independence and lower mortality rates twelve months after hospital discharge.[40] Further factors fueling higher mortality rates include a lack of knowledge causing delays in seeking stroke treatment, as well as limited stroke networks for post-stroke care.[39]

We identified three studies that included only posterior circulation stroke patients.[27,31,32] The recanalization effectiveness reported in these studies is similar to that found in a systematic review by Watson et al. This review described successful reperfusion measured by the Thrombolysis in Cerebral Infarction score of 2b−3 in 86% of stroke patients.[49] Similarly, functional independence was achieved in 38% of patients, which resembles the findings in our study. Moreover, mortality ranged from 4 to 64%, which lies within the mortality rates reported in the three studies identified in our review.[49]

Limitations

The main limitation of our study faced was the lack of a meta-analysis of the data from the included studies. Although the authors originally considered conducting a meta-analysis, it was not possible due to methodological differences. These were mainly driven by the heterogeneity in study designs, such as the lack of comparison groups and differences in selection criteria regarding the time window for MT. The lack of a comparison group was the main reason for classifying studies as poor quality. Most of the studies also lacked a representative sample, constituting a considerable limitation in generalizing their findings. Nonetheless, there is consistency in the outcomes of the studies in our review, including wider comparisons with available international literature.

Conclusions

Advancements in stroke care in Latin American countries were evidenced by MT use rates comparable to international levels. The data regarding safety outcomes and the effectiveness of MT was consistent across the studies we examined, not to mention supported by the available literature. However, mortality rates did remain high. The poor quality of evidence and the limited number of eligible countries suggests that further research is necessary. Future studies on MT outcomes in both public and private healthcare settings throughout Latin America would be greatly beneficial, but they must be conducted using standard time window criteria and reduce the risk of bias by including representative samples and comparison groups

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jstrokecerebrovasdis.2022.106972.

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