Original Article

Access to endovascular thrombectomy treatment for stroke patients with large vessel occlusion in Northern Ontario

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Abstract

Introduction: Globally, stroke is the second-leading cause of death and the third-leading cause of combined death and disability. Stroke caused by large vessel occlusion (LVO) carries high morbidity and mortality. Endovascular thrombectomy (EVT) has improved the outcome of patients with LVO-related stroke. Despite therapeutic advances, timely access to EVT remains a critical challenge in many parts of the world, particularly large geographical areas with low population density and rural/remote regions. Our study aimed to share the real world data on the outcome of patients treated with EVT in a large geographic region with long transfer distances and high representation of rural and remote populations.

Methods: We conducted a retrospective analysis of the first 103 patients treated between February 2020 and December 2022 at a newly launched regional EVT programme in Northeastern Ontario, Canada. Data included patient demographic, clinical characteristics, treatment metrics and 90-day functional outcomes assessed by modified Rankin score (mRS).

Results: Establishment of a regional EVT programme led to a significant improvement in the access to EVT treatment (<1% prelaunch to ~6% postlaunch). Median transport distances between the site of initial stroke presentation to the EVT centre decreased substantially from 450.80 km pre-launch to 108.04 km post-launch. Over half of the treated patients (53/103, 51.5%) were ambulating independently (mRS 0–3) while mortality was 39.8%. Younger age (odds ratio [OR] 0.896, 95% confidence interval [CI] 0.824–0.975; P = 0.011), lower stroke severity (0.840, interquartile range [IQR] 0.745–0.946, P = 0.004) and shorter time from symptom onset to reperfusion (0.796, IQR 0.677–0.936, P = 0.006) were associated with lower odds of unfavourable outcomes (mRS 4–6).

Conclusion: Our study shows improved access to EVT treatment after the establishment of a regional EVT programme. About 51.5% of patients had favourable outcomes with LVO-related stroke following EVT in a large geographic region with long transfer distances and high representation of rural and remote

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populations. More data are needed from similar regions across the globe to help understand treatment and outcome trends following EVT and strategies to improve EVT access.

Keywords: Endovascular thrombectomy, large vessel occlusion, large vessel occlusion-related-stroke, rural endovascular thrombectomy

Résumé

Introduction: À l'échelle mondiale, l'AVC est la deuxième cause de décès et la troisième cause de décès et d'invalidité combinés. Les AVC causés par une occlusion de gros vaisseaux (OGV) entraînent une morbidité et une mortalité élevées. La thrombectomie endovasculaire (TE) a amélioré les résultats chez les patients victimes d'un AVC lié à une OGV. Malgré les progrès thérapeutiques, l'accès rapide à la TE reste un défi majeur dans de nombreuses régions du monde, en particulier dans les zones géographiques vastes à faible densité de population et dans les régions rurales/isolées. Notre étude visait à partager des données réelles sur les résultats obtenus chez les patients traités par TE dans une région géographique vaste, caractérisée par de longues distances de transfert et une forte proportion de population rurale et isolée.

Méthodes: Nous avons mené une analyse rétrospective des 103 premiers patients traités entre février 2020 et décembre 2022 dans le cadre d'un programme régional de TE récemment lancé dans le nord-est de l'Ontario. Les données comprenaient les caractéristiques démographiques et cliniques des patients, les paramètres de traitement et les résultats fonctionnels à 90 jours évalués à l'aide du score de Rankin modifié.

Résultats: La mise en place d'un programme régional de TE a permis d'améliorer considérablement l'accès au traitement par TE (moins de 1% avant le lancement, environ 6% après le lancement). La distance médiane entre le lieu de la première manifestation de l'AVC et le centre de TE a été considérablement réduite, passant de 450,80 km avant le lancement à 108,04 km après le lancement. Plus de la moitié des patients traités (53/103, 51,5%) pouvaient marcher de manière autonome (mRS 0-3), tandis que le taux de mortalité était de 39,8%. Un âge plus jeune (OR 0,896, CI à 95% 0,824-0,975; P = 0,011), une gravité moindre de l'AVC (0,840, IC 0,745-0,946, P = 0,004) et un délai plus court entre l'apparition des symptômes et la reperfusion (0,796, IC 0,677-0,936, P = 0,006) étaient associés à un risque moindre d'issues défavorables (mRS 4-6).

Conclusion: Notre étude démontre une amélioration de l'accès au traitement de TE après la mise en place d'un programme régional de TE. Environ 51,5% des patients ont obtenu des résultats favorables après un AVC lié à une OGV suite à un traitement de TE dans une vaste région géographique caractérisée par de longues distances de transfert et une forte proportion de populations rurales et isolées. Il est nécessaire de disposer de davantage de données provenant de régions similaires à travers le monde afin de mieux comprendre les tendances en matière de traitement et de résultats après un traitement de TE, ainsi que les stratégies visant à améliorer l'accès à ce traitement.

Mots-clés: Thrombectomie endovasculaire (TE), occlusion de gros vaisseaux (OGV), accident vasculaire cérébral lié à une OGV, TE en milieu rural

INTRODUCTION

Globally, stroke is the second-leading cause of death and the third-leading cause of combined death and disability.[1] Large vessel occlusion (LVO) stroke occurs due to acute occlusion of the proximal cerebral circulation (intracranial internal carotid artery [ICA], proximal middle cerebral artery [MCA] and basilar artery) and accounts for approximately 24%–46% of acute ischemic stroke (AIS), with two-thirds of LVO occurring in the anterior circulation.[2,3] LVO strokes are associated with high morbidity and mortality. In 2015, five randomised controlled trials demonstrated the efficacy and safety of endovascular thrombectomy (EVT) for AIS and EVT is now the standard of care for AIS with proximal LVO in the anterior circulation.[4,5] The number needed to treat to reduce disability (at least one point on the modified Rankin scale at 90 days) is 2.6, making it one of the most effective stroke treatments.[6] Patients can be treated up to 24 h after stroke onset when carefully selected using advanced imaging.[7,8] However, the benefit of EVT is time dependent with each 1-h delay to reperfusion associated with reduced functional independence by about 19%.[5] Despite the wide treatment window, the time to treatment remains the most robust predictor of stroke outcomes.[5,9]

A recent survey shows that access to EVT globally is low.[10] In Canada, a previous modelling study demonstrated appropriate geographic access to stroke services in Northern Ontario communities, with the exception of EVT,[11] with only 3.3% of rural population within 60 min of an EVT centre.

The Ontario stroke report demonstrated low EVT access at <2% in Northeastern Ontario in 2020–2021[12] and rates were even lower in 2018–2019 at <1%. A large geographical area with long travel times, lower population density, weather-related challenges during winter months and lack of EVT centres in the north are the main contributors to limited EVT access in Northern Ontario. Although ample data exist about outcomes following EVT from high volume centres, data are limited from the regions with large geographies, long transfer distances and high representation of rural and remote populations. The data are needed from these regions across the globe to help understand treatment and outcome trends following EVT and strategies to improve EVT access.

Northeastern Ontario is one of the six health regions in Ontario serving more than 557,000 people distributed across a vast geography of over 273,580 km.[2,13] This geographical area covers 30.6% of Ontario's land mass and significant numbers live in rural and remote communities. The largest urban community in the region is Sudbury with a population of 165,958. A regional EVT program at Health Sciences North (HSN) Sudbury was launched in February 2020 to reduce geographical disparity and treatment delay to receive EVT for the population of Northeastern Ontario. The aim of our study was to investigate EVT access to patients with LVO in Northeastern Ontario following the launch of our regional EVT program and report their 90-day functional outcomes of treated patients.

METHODS

The EVT programme at HSN Sudbury was established in February of 2020. This regional program consisted of 8 designated stroke centres[14] and organized using a hub and spoke model with 7 EVT referring sites (spokes), which were designated stroke hospitals in the Northeastern Ontario region (3 district stroke centres and 4 telestroke referring sites), and a single EVT site (hub) in Sudbury. Figure 1 shows hub and spoke sites. Service levels of different stroke centres are described in Figure 2.[14]

Prior to launch of the EVT program, patients seen in the emergency department (ED) of any of the stroke centres in Northeastern Ontario (all 8 sites including Sudbury) were assessed by the on-site stroke physician (ED physician, family physician on-call, internist, intensivist and neurologist based on the local physician model) followed by acute stroke imaging (computed tomography (CT) head and CT angiogram of the head and neck). Patients with acute stroke symptoms in the community were transported to the nearest designated stroke centre by Emergency Medical Services (EMS). If the nearest centre was a non-stroke hospital, EMS used acute stroke bypass protocol to bypass a closer hospital and redirect transport to the appropriate designated stroke centre (using EMS prompt card).[16] Non-stroke hospitals were also able to activate bypass protocol if a patient presented in the treatment window and needed a transfer to a designated stroke centre. After clinical assessment and imaging, CritiCall Ontario[17] was used to call a telestroke neurologist. CritiCall Ontario is a 24-h-a-day emergency referral and consultation service for physicians based in acute care hospitals across the province of Ontario.[17] A telestroke neurologist is a neurologist participating in the provincial telestroke program. The provincial telestroke programme[18] provides access to a standard-of-care-hyperacute-stroke patient assessment and management for Ontario residents. The program is supported by a group of neurologists (telestroke neurologist) and provides support for clinicians who lack the expertise to assess and treat patients. If the patient was eligible, intravenous thrombolysis was delivered at the referring sites. If a LVO was identified, the patient was emergently transported to the mapped EVT site under provincial 'Life or Limb policy'.[19] Prior to February 2020, these patients were transferred to EVT centres in Southern Ontario [Toronto or London, Figure 1] based on EVT mapping. From February 2020, these patients were transported to HSN Sudbury [Figure 1]. For emergent transport, patients were exclusively airlifted to EVT centres in Southern Ontario (Toronto or London) before the launch of our EVT program

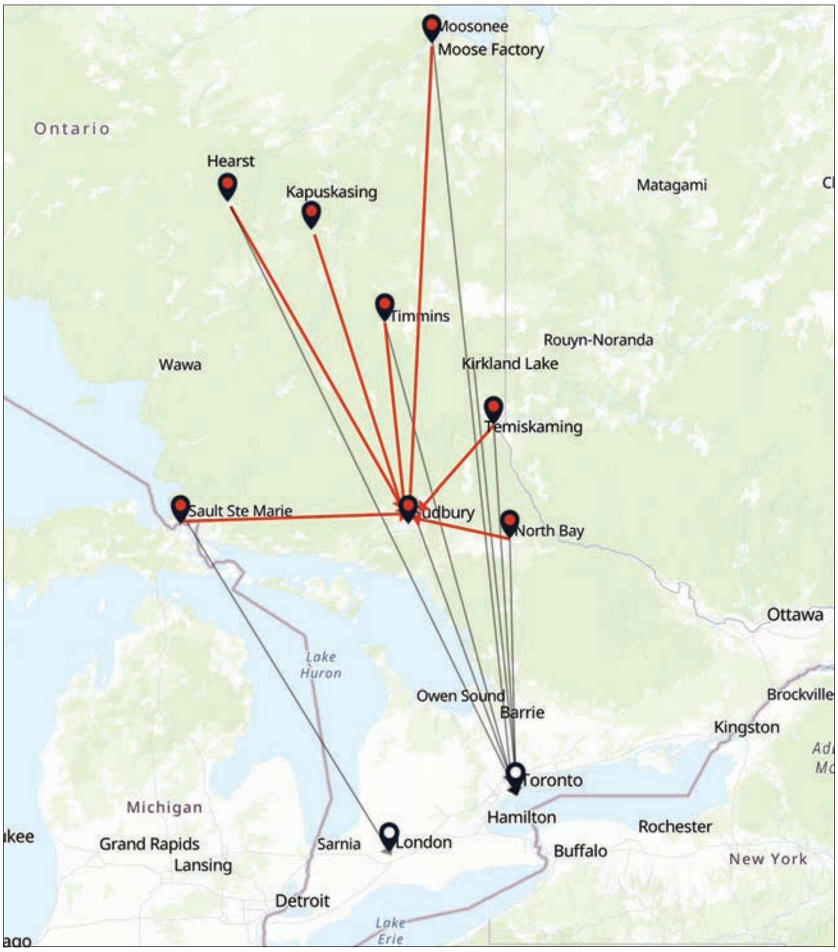

Figure 1: A map illustrating the hub-and-spoke model for EVT access in Northeastern Ontario. Stamps with red centre are referring sites (spokes) and stamps with white centre are EVT sites (hub). Black lines represent patient transport routes to EVT centres in Southern Ontario (Toronto and London) prior to the establishment of the regional EVT program. Red lines show current patient transport pathways following the launch of the regional EVT program in Sudbury, serving the Northeastern Ontario region.

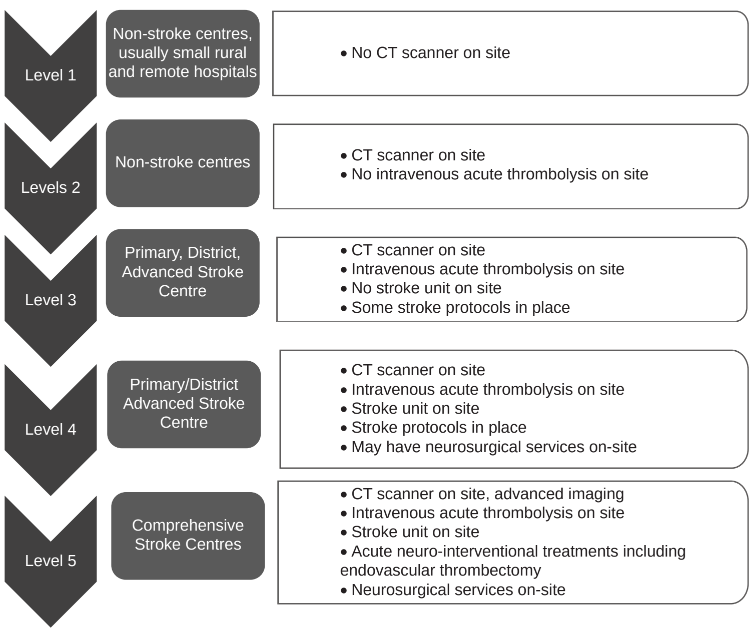

Figure 2: Service levels of Hospitals: Adapted from Canadian stroke best practice recommendations.[15]

in Sudbury, due to long travel distances. With the establishment of the EVT program in Sudbury, land transport became an option for patients in some of the closer regional telestroke-referring sites, reducing the reliance on air ambulance.

We reviewed the clinical, imaging, treatment and outcome data of the first 103 patients treated between February 2020 and December 2022. The data were prospectively collected in a quality improvement EVT registry. Clinical data were extracted by a trained data abstractor to enter in the registry. A standardised form was used to collect demographic information, medical history including vascular risk factors, referring site, mode of arrival, distance of transfer, stroke severity on the National Institute of Health Stroke Scale (NIHSS) and tissue plasminogen activator administration. Data collected from imaging included the Alberta stroke program early CT score (ASPECTS), site of occlusion, collateral status, details on EVT treatment, perfusion outcome (captured on modified thrombolysis in cerebral infarction TICI] score) and workflow metrics. This was completed in real-time by the treating stroke neurologist and neurointerventionist at the conclusion of the procedure and entered into the customised EVT form. The transport distance was calculated using the most direct road distance (on Google maps) between the referring centre (home was used if the patient presented directly to HSN) and the EVT centre (HSN). We used aerial distance as being available for patients transported from James Bay coast as there is no road access available. Access to EVT was defined by the proportion of patients with ischemic stroke in the region receiving EVT treatment in a given year. We used 2022 as the final study year as the program was a full 24/7 service during that year (number of patients treated with EVT/total ischaemic stroke in the region during a given year). Functional outcomes were assessed by the stroke neurologist using a modified Rankin score[20] (mRS) at 3 months. The modified Rankin scale is a 7-point scale ranging from 0 (no symptoms) to 6 (death). A score of 3 or less (modified mRS 0–3) indicates functional independence in mobility and was considered a good outcome while mRS 4–6 was defined as a poor outcome. The data quality was checked regularly by the study principal investigator.

Data are reported using the standard descriptive statistics. Frequency (percentage) is presented for the categorical or ordinal variables. Normality of data distribution was assessed using the Shapiro–Wilk test. The continuous variables are presented as mean (SD) for normally distributed data or median (interquartile range, IQR) for non-parametric data. Student's t-test, Mann–Whitney U-test and the Fisher exact test were used as appropriate. Logistic regression was used to build a multivariable model testing the association between baseline clinical and imaging variables and good patient outcome (mRS 0–3). All variables with $P < 0.20$ in the univariate analysis were included in the multivariable logistic regression model and the final parsimonious model was achieved using backward elimination. SPSS (IBM, Illinois, USA) was used for the statistical analysis.

All patient data were collected according to the Canadian Tri-Council policy statement on ethical conduct for research involving the secondary use of data originally collected for health care purposes and was approved by HSN's Research Ethics Committee. Waiver of consent was obtained allowing consecutive patient enrolment.

RESULTS

Between February 2020 and December 2022, 103 patients were treated with EVT in Northeastern Ontario for LVO. A summary of patient clinical characteristics, vascular risk factors, workflow and post-EVT perfusion outcomes are shown in Table 1.

Regional EVT access improved from <1% pre-launch between 2018 and 2019 to ~6% in 2022 when the program became a full 24/7 service. A total of 41 patients (39.8%) were regionally transferred patients, 48 (46.6%) were patients presenting directly to HSN and the remaining 14 patients (13.6%) were from community hospitals near Sudbury (for example, Elliot Lake, Little Current, Mindemoya). The majority of interfacility transfer occurred using air ambulance (31 patients, 30.1%) while 67 patients (65%) were transferred using land ambulance. The remaining 5 patients (4.9%) were self-transports. The average transfer distance to the EVT centre reduced significantly to 108.04 km compared to 450.80 km if these patients were treated using referral pathways before the launch of the regional EVT program.

Table 1: Clinical characteristics, workflow and perfusion outcomes of patients

Variable	All patients (*n*=103), *n* (%)
Clinical characteristics	
Age (years), median (IQR)	70 (61–70)
Male sex	55 (52.4)
Hypertension	76 (73.8)
Dyslipidaemia	64 (62.1)
Diabetes mellitus	30 (29.1)
Atrial fibrillation	30 (29.1)
Coronary artery disease	26 (25.2)
Congestive heart failure	10 (9.7)
Prior stroke	25 (24.3)
Current smoker	39 (37.9)
NIHSS, median (IQR)	16 (10–20)
IV tPA	40 (40.8)
Baseline imaging	
Location of occlusion	
Intracranial ICA	4 (3.9)
ICA + M1	11 (10.7)
M1	60 (58.3)
M2	23 (22.3)
Tandem cervical ICA*	36 (36.7)
Basilar	5 (4.9)
ASPECTS, median (IQR)*	8 (6–9)
Moderate to good collaterals*	87 (88.8)
Workflow metrics and reperfusion**	
Onset to door time, h (IQR)	4.15 (1.05–7.50)
Onset to CT time, h (IQR)	4.37 (1.22–7.58)
Onset to puncture time, h (IQR)	5.4 (3.36–9.25)
Onset to reperfusion time, h (IQR)	7.40 (5.08–10.44)
Final reperfusion of mTICI 2b-3	84 (81.6)

*Among patient with anterior circulation occlusion (*n*=98), **median (IQR). mTICI: Modified thrombolysis in cerebral infarction score, CT: Computed tomography, EVT: Endovascular thrombectomy, IQR: Interquartile range, ASPECTS: Alberta stroke program early CT score, ICA: Internal carotid artery, NIHSS: National Institute of Health Stroke Scale, IV: Intravenous, tPA: Tissue plasminogen activator

The demographic, medical and clinical variables are shown in Table 1. The median age of the cohort was 70 years and 52.4% were men. Hypertension (73.8%) and dyslipidaemia (62.1%) were the most common vascular risk factors while atrial fibrillation was present in almost a third of patients (29.1%). The median NIHSS score was 16 (IQR 10–20) and median ASPECTS was 8 (IQR 6–9). The most common location of LVO was the M1 segment of the MCA (60 patients [58.3%]) and tandem cervical ICA severe stenosis/occlusion was seen in 36 patients (36.7%). Leptomeningeal collaterals were moderate to good in 87 patients (88.8%).

In terms of workflow metrics, the median onset to door time at HSN was 4.15 h (IQR 1.05–7.50 h), onset to CT time was 4.37 h (IQR 1.22–7.58) and onset to puncture time was 5.4 h (IQR 3.36–9.25). The median onset to reperfusion time was 7.4 h (IQR 5.08–10.44). The final reperfusion of mTICI 2b-3 was achieved in 84 (81.6% of patients). Of the 103 patients, 53 (51.5%) were shown to have a good outcome (mRS 0–3) and 50 (48.5%) were shown to have a poor outcome (mRS 4–6). Mortality rate was 39.8%. The individual Rankin levels of the entire cohort are provided in Table 2. A good outcome was noted in 28 of 48 (58.3%) patients presenting directly to the EVT centre in Sudbury, 6 of 14 patients (42.9%) from surroundings areas near Sudbury and 19 of 41 (46.3%) of regionally transferred patients. Although patients directly presenting to the EVT centre had numerically better functional outcome, these differences were not statically different. The small sample size limited further comparison.

The univariate and multivariate analysis of the predictors of good versus poor outcome is shown in Table 3. In the final model, age (OR 0.896, 95% CI 0.824–0.975; $P = 0.011$), stroke severity (0.840, IQR 0.745–0.946, $P = 0.004$) and onset to reperfusion (0.796, IQR 0.677–0.936, $P = 0.006$) time showed significant association with functional outcomes.

DISCUSSION

Our study is the first to report access to EVT treatment and functional outcome of the EVT treated population using the real-world data in Northern Ontario. Launch of the regional EVT program improved regional EVT access from <1% pre-launch to ~6% (contemporary provincial EVT access rate was ~7%) when it became a full-time service while reducing transport distances of the treated population by almost 75% (average 108.04 km post-launch vs. 450.80 km pre-launch). A good functional outcome (defined as ambulating independently) occurred in 51.5% of patients. The median stroke onset to EVT centre arrival time was still long at 4.15 h (compared to ~2.2 h in the ESCAPE trial[4] which was one of the 5 landmark EVT trials with largest representation of the Canadian population), reflecting the extensive geographic area and other factors contributing to the delay in reaching the EVT centre. Our study offers

Table 2: Modified Rankin score at 90 days		
mRS category	Description	Frequency (%)
0	No symptoms at all	12 (11.7)
1	No significant disability despite symptoms: Able to carry out all usual duties and activities	14 (13.6)
2	Slight disability: Unable to carry out all previous activities but able to look after own affairs without assistance	14 (13.6)
3	Moderate disability: Requiring some help, but able to walk without assistance	13 (12.6)
4	Moderately severe disability: Unable to walk without assistance and unable to attend to own bodily needs without assistance	7 (6.8)
5	Severe disability: Bedridden, incontinent and requiring constant nursing care and attention	2 (1.9)
6	Dead	41 (39.8)
Total		103 (100.0)

mRS: Modified Rankin score

Table 3: Univariate and multivariate analysis of predictors of good outcome

	Good outcome (mRS 0–3) (*n*=53), *n* (%)	Poor outcome (mRS 4–6) (*n*=50), *n* (%)	*P*	OR (95% CI)	*P*
Clinical characteristics					
Age (years), median (IQR)	64 (57.50–75)	75 (65–80.50)	0.001	0.896 (0.824–0.975)	0.011
Male sex	31 (58.5)	23 (46)	0.239		
Hypertension	38 (71.7)	38 (76)	0.660		
Dyslipidaemia	31 (58.5)	33 (66)	0.543		
Diabetes mellitus	13 (24.5)	17 (34.7)	0.284		
Atrial fibrillation	12 (22.6)	18 (36.7)	0.133		
Coronary artery disease	13 (24.5)	13 (26)	1.000		
Congestive heart failure	4 (7.5)	6 (12)	0.518		
Prior stroke	11 (20.8)	14 (28)	0.492		
Current smoker	24 (45.3)	15 (30)	0.155		
NIHSS, median (IQR)	12 (8.5–18)	18 (14–23)	0.078		
IV tPA	26 (51)	14 (29.8)	0.041	0.840 (0.745–0.946)	0.004
Baseline imaging					
Location of occlusion					
Intracranial ICA	3 (5.7)	1 (2)	0.370		
ICA + M1	4 (7.5)	7 (14)			
M1	31 (58.5)	29 (58)			
M2	13 (24.5)	10 (20)			
Tandem cervical ICA**	19 (37.3)	17 (36.2)			
Basilar	2 (3.8)	3 (6)			
ASPECTS, median (IQR)**	8 (7–9)	7 (6–9)	0.193		
Moderate to good collaterals**	49 (96.1)	38 (80.9)	0.024		
Workflow metrics and reperfusion*					
Onset to door time, h (IQR)	3.02 (0.59–6.11)	5.09 (1.44–10.21)	0.045		
Onset to CT time, h (IQR)	3.48 (1.13–6.24)	5.27 (2.29–10.41)	0.023		
Onset to puncture time, h (IQR)	5.17 (3.25–8.17)	7.22 (4.11–11.93)	0.057		
Onset to reperfusion time, h (IQR)	6.54 (4.42–9.20)	8.37 (6.41–12.90)	0.039	0.796 (0.677–0.936)	0.006
Final reperfusion of mTICI 2b-3	50 (94.3)	34 (68)	0.001	0.129 (0.009–1.902)	0.136

*Among patient with anterior circulation occlusion (*n*=98), **Median (IQR). EVT: Endovascular thrombectomy, mTICI: Modified thrombolysis in cerebral infarction score, CT: Computed tomography, OR: Odds ratio, IQR: Interquartile range, CI: Confidence interval, IV: Intravenous, tPA: Tissue plasminogen activator, ICA: Internal carotid artery, NIHSS: National Institute of Health Stroke Scale, ASPECTS: Alberta stroke program early CT score, mRS: Modified Rankin score

crucial real-world data from Northern Ontario, where a significant portion of the population lives in rural and remote communities.

Factors associated with good functional outcome were age, stroke severity and onset to reperfusion time and are in line with the previous data.[5,21-25] Our population did differ from patients enrolled in previous EVT trials.[4-8] For example, our patients were older (median age = 70 years) compared to patients in the HERMES collaboration[6] (median age = 68 years), which pooled the data from all 5 early window clinical trials. The time to treatment and reperfusion was also longer (median time to reperfusion 7.4 h vs. 4.75 h in HERMES). In addition, our patients had a much higher burden of tandem disease (36.7% vs. 9.5% in HERMES). Finally, the rate of intravenous thrombolysis was lower at 40.8% compared to ~70% in HERMES, as our patients included both early and late window patients.

We noted higher mortality of 39.8% in our cohort compared to clinical trials. In the HERMES collaboration, 90-day mortality in the endovascular arm was 15.3% compared to 18.9% in the control population,[6] while the extended window DEFUSE 3 trial showed a mortality rate of 14% in the endovascular-therapy group and 26% in the control group.[8] In contrast, in the real-world practice, 90-day mortality seems to be higher. A recent prospective observational study reported a higher mortality rate (up to 51.5 in older adults) - results in line with our data.[23] Older age, longer time to treatment, presence of significant vascular burden (i.e., high prevalence of tandem disease) and low use of intravenous thrombolysis could explain our higher mortality rate. Lower use of thrombolysis was likely a reflection of wider treatment window for EVT (and the study only included EVT treated patients vs all ischemic stroke patients). In our experience, nonmedical factors significantly influence mortality among patients with anticipated poor outcomes. For instance, treating physician's prognostic perception; local variations in palliative care, practices; healthcare system (public health care vs. private insurance); aging population with complex healthcare needs and a strained local health care system and the community resources available to support patients with anticipated poor outcomes all impact the decisions made by physicians and caregivers or families regarding goals of care.

Although sample data exist about the outcomes following EVT from high volume centres, data are limited from the regions with large geographical populations, long transfer distances and high representation of rural and remote populations. A previous Australia and New Zealand experience among patients with ultra-long transfers showed a benefit for EVT, with outcomes similar to those treated in the comprehensive stroke centre in the EVT extended window trials.[25] Our real-world data from a region in Northern Canada – representing a region with long transfer distances and a high rural and remote population – also show favourable outcomes in patients with LVO-related stroke following EVT. More data are needed from similar regions across the globe to help understand treatment and outcome trends following EVT and strategies to improve EVT access. Improving emergent patient transport, use of telemedicine (including innovative technology that allows procedures to be performed remotely), telerehabilitation and rural stroke coordinators in strategic locations might be some strategies to improve access to EVT and stroke care in general in rural and remote communities.

One of the major limitations of our study was the absence of a historical control arm to compare patient outcomes before and after the launch of the EVT program. Additionally, there were very few patients treated with EVT prior to the establishment of the regional EVT program and only regional administrative data were available, which lack detailed information on patient characteristics. Although this data comprehensively captures EVT cases and is part of a special project by the Canadian Institute for Health Information (CIHI), we were unable to access patient-level data due to privacy and data-sharing regulations which limited our ability to compare the data.

CONCLUSION

Our study is the first to report access to EVT treatment and the functional outcome of the EVT treated population in Northern Ontario using the real world data. Launch of the regional EVT program improved population access to EVT from <1% pre-launch to ~6% when it became a full-time service while reducing transport distances of the treated population by almost 75%. Despite a mortality rate of 39.8%, half of the patients were able to achieve independent ambulation. Our population was older, had longer time to treatment, lower use of intravenous thrombolysis and had a higher prevalence of tandem disease. The study provided crucial data from a large geographical region in Northern Ontario, with low population density, significant representation of rural and remote communities, limited resources and weather-related challenges. Future studies from other parts of the world with similar geography and patient demographics would help us better understand trends in EVT access, outcome following treatment as well as systemic challenges in the delivery of acute stroke treatment and opportunities to improve care in these regions.

Consent to participate: waiver of consent was obtained from REB allowing consecutive patient enrolment.

Data availability statement: Data is available upon reasonable request from the corresponding author.

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Conflicts of interest: There are no conflicts of interest.

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