Stroke thrombolysis in New Zealand: data from the first 6 months of the New Zealand Thrombolysis Register

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ABSTRACT

The New Zealand National Stroke Network introduced a National Stroke Thrombolysis Register on the first of January 2015 to assist with quality assurance and continuous service improvement. In the first 6 months, there were 179 [75 women, mean (SD) age 69.9 (14) years] treated with stroke thrombolysis out of a total of 2,796 ischaemic stroke patients, giving a national thrombolysis rate of 6.4%. The median [Inter-quartile range (IQR)] onset-to-treatment time was 154 (125–190) minutes, and the median (IQR) door-to-needle time was 74.5 (55.7–105.0) minutes. The rate of symptomatic intracranial haemorrhage following thrombolysis was 4.4%. These results are similar to other international centres, and indicate an approximate doubling of the proportion of stroke patients treated with stroke thrombolysis since a 2009 national audit. However, there is need for on-going efforts to improve treatment rates and process efficiency, particularly door-to-needle times.

Thrombolysis with intravenous (IV) alteplase is recommended by New Zealand and international guidelines for patients with ischaemic stroke who are able to be treated within 4.5 hours of onset.[1] Thrombolysis should be given under the authority of a physician trained and experienced in acute stroke management, and should only be undertaken in hospitals with appropriate infrastructure, facilities, and network support.[1] The delivery of this treatment has been shown to be feasible in large, medium-sized and some small district health boards (DHBs) in New Zealand.[2-4]

A retrospective national audit of acute stroke services in New Zealand in 2009 showed that only 3% of ischaemic stroke patients were treated with thrombolysis.[2] This was despite the fact that greater than 80% of the New Zealand population lived in catchment areas where DHBs offered thrombolysis. The main barriers to thrombolytic therapy included delays in reaching hospital, triaging priorities in the emergency department (ED) and delays in obtaining urgent imaging. The 2010 New Zealand Clinical Guideline emphasised the need for the collection of data in a central register of all patients treated with thrombolysis to allow for national benchmarking, quality assurance and service improvement.[1] In 2014, a combined emergency and stroke physician consensus statement recommended the establishment of a national database to audit stroke thrombolysis and outcomes.[5] Previous locally-driven thrombolysis data collection has been variable.[6]

The National New Zealand Thrombolysis Register was introduced by the National Stroke Network in January 2015. Here, we report the data collected in the first 6 months of the register in order to provide a current account of the thrombolysis practices in New Zealand.

Table 1: Baseline characteristics of patients treated with thrombolysis.

Characteristic	n (%)
Age, mean (SD)*	69.9 (14)
Age ≥80 years, n (%)	53 (29.6)
Male, n (%)	104 (58.1)
Ethnicity, n (%)	
NZ European	90 (54.5)
Māori	23 (13.9)
Pacific	10 (6.1)
Asian	11 (6.7)
Other European	29 (17.6)
Other	2 (1.2)
Region, n (%)	
Northern	59 (33.0)
Midland	38 (21.2)
Central	44 (24.6)
South Island	38 (22.4)
Treated out of hours**, n (%)	105 (58.6)

*SD = standard deviation; **refers to outside of regular work hours which are defined as 8am to 5pm, Monday to Friday.

Methods

The thrombolysis register consists of an Excel spreadsheet developed by members of the National Stroke Network. The information recorded includes demographic information, time of symptom onset, hospital arrival, CT scanning, and alteplase bolus, as well as complications such as symptomatic intracranial haemorrhage (sICH) and whether the patient is alive at Day 7. Symptomatic ICH was defined as any intracranial haemorrhage and ≥4 point increase in National Institutes of Health Stroke Scale (NIHSS) score within 24 hours of treatment.[7] Data collection to capture 3-month functional outcome was not currently feasible with available staff resources.

In late 2014, the register template was distributed to lead stroke clinicians to all New Zealand hospitals offering stroke thrombolysis. Clinicians from each hospital were asked to prospectively record data starting on 1 January 2015 for each thrombolysed patient. The register data from each hospital was submitted to a central co-ordinator every 3 months for collation and subsequent analysis. Clinicians were instructed to de-identify patient data prior to submission.

The combination of ischaemic strokes and strokes unspecified were used as the denominator for thrombolysis rates in accordance with Ministry of Health (MoH) thrombolysis indicator reporting guidelines. Ischaemic strokes and strokes unspecified were recorded via the National Minimal Dataset and cross checked against individual DHB or regional data at the time of analysis. The reason for including "stroke unspecified" is that some DHBs had significant proportions of strokes that had not been specified as either heamorrhagic or ischaemic/infarction, and several internal audits have demonstrated that most of these strokes are cerebral infarctions.

The 20 DHBs in New Zealand are grouped into four regions: Northern, Midland, Central, and South Island for the purpose of benchmarking, collaborative planning and resourcing of health services. Numbers were too small to allow meaningful analysis at individual DHB level. DHBs were also grouped according to the population they serve into small (<125,000 population), medium (125,000–250,000) and large (>250,000). The data were analysed according to the region as well as according to DHB size. Data analysis was conducted using Microsoft Excel and Stata 12.1.

Results

From 1 January 2015 to 30 June 2015, there were 2,796 patients with ischaemic stroke and stroke unspecified admitted to New Zealand hospitals. Over the same period, there were 179 (6.4%) patients (75 women, mean [SD] age 69.9 [14] years) treated with IV alteplase. There was complete data for 165. Six patients had strokes as an inpatient (3.4%). Fourteen patients had partially missing time data; however, their data were included in the analysis where available. Patient characteristics are presented in Table 1.

Approximately one-third of the patients treated with thrombolysis were over the age of 80 years, consistent with the proportional contribution of this age group to all strokes. The overall median (interquartile range, [IQR]) time delay between hospital arrival and delivery of alteplase bolus (door-to-needle time) was 74.5 (55.7–105) minutes, with a range of 20–210 minutes. The median [IQR] door-to-needle time for patients treated

Table 2: Time delay in minutes by region (median [IQR]) and proportion treated within less than 60 minutes of arrival and 3 hours of onset (%, n/n).

	Northern	Midland	Central	Southern	National
Onset-to-door	72 (48–98)	86 (60–115)	68 (51–93)	70 (51–95)	72 (52–101.5)
Door-to-CT	30 (21–39)	28 (21–38)	32 (24–44)	34 (17–42)	30 (21–42)
Door-to-needle	82 (62.5–110)	69.5 (56–92.8)	74 (45.3–105)	69 (59–96.5)	74.5 (55.7–105)
≤60 mins	23.6 (13/55)	30.6 (11/36)	40.5 (17/42)	28.6 (10/35)	30.4 (51/168)
Onset-to Needle	160 (136–204)	157 (137–193)	143 (118–196)	153 (126–165)	155 (128.5–195)
≤3 hours	63 (36/57)	61 (22/36)	75 (30/44)	82 (31/38)	68 (119/175)

out-of-hours was 82 (58–118) minutes, and in-hours 69 (52–99) minutes; a statistically significant difference of 13 minutes (p=0.045). Approximately one-third of all patients were treated within the 'golden hour' of 60 minutes from stroke onset.

The data for each region is presented in Table 2, along with the times for onset to hospital arrival ('onset-to-door'), door-to-CT, door-to-needle, and onset-to-needle times. An onset-to-treatment time of 3 hours or less was achieved in 122/179 (68%) of patients. Five patients (2.9%) were treated outside of best practice guidelines beyond the 4.5 hours cut-off point (mean 9 minutes; range 5 to 15 minutes). None of these patients suffered complications including no sICHs.

Eight of the 179 (4.4%) patients had sICH following thrombolysis. Ten (5.6%) patients had died by 7 days, including 2 (1.1%) deaths in patients with sICH. The sICH and mortality rates in individuals aged ≥80 years were 5.5% and 8.9%, respectively; higher than in individuals <80 years old (4.0% and 4.1%). However, neither of these differences were statistically significant (sICH p=0.69 and mortality p=0.19). Other complications included angioedema in two (1.1%) and extra-cranial haemorrhage in two (1.1%) patients.

There was variation depending on DHB size. The thrombolysis rate was 4.7% at small DHBs, 6.1% at medium-sized DHBs, and 8.4% at large DHBs, but the differences were not statistically significant (p=0.14). There were also differences in median (IQR) door-to-needle times, which were 88 (58–103) minutes at small, 79 (62.5–116.5) minutes at medium, and 71.5 (51–99) minutes at large DHBs, although again, these differences were not statistically significant (p=0.28). Tertiary hospitals (Auckland, Waikato, Wellington, Christchurch, Dunedin), however, treated patients significantly faster with a median (IQR) of 67.5 (47–95) minutes compared to 81 (62–110) for patients treated in non-tertiary hospitals (p=0.014).

Discussion

This report provides an account of thrombolysis practices in New Zealand between 1 January and 30 June 2015. This has been clinician initiated and achieved, without specific funding support to either set-up a national registry, or for DHB staff to collect the data.

Since 2009, the thrombolysis rate has more than doubled from 3% to 6.4%, which meets the current MoH thrombolysis target of 6%. This is similar to the national thrombolysis rate of 7% in Australia (2012),[8] but lower than 9.1% in England (2011).[9] With rates of >30% achievable in some well-organised centres,[10] it is likely that the current MoH target will need to be updated in the not too distant future.

There is room to not only increase treatment rates, but also reduce treatment delays. Earlier treatment is associated with better outcomes, and every 15-minute acceleration in the start of treatment can

result in 4% greater odds of walking independently on discharge.[10-13] Improving the onset-to-treatment time will require increased efficiency at multiple steps, including the onset-to-door time, door-to-CT time and CT-to-needle time.[10,13]

The registry data shows that the pre-hospital onset-to-door time contributed nearly 50% to the total onset-to-treatment time. While some of this is unavoidable due to geographic distances, especially in rural areas, many people still wait too long to call emergency services. In order to address this, a national campaign based on the FAST message ('Face, Arm, Speech, and Time') is currently underway. Similarly, ongoing collaboration with emergency services is vital to ensure that stroke patients are given high priority, and pre-hospital notification is routinely used to alert the stroke team.

The median door-to-needle times achieved in all regions are higher than the recommended target of 60 minutes.[1] One rate-limiting step is the door-to-CT time. The most effective systems have protocols that facilitate the stroke team to meet the patient at the hospital door and proceed straight to imaging.[10] This may not be possible in smaller hospitals, where the stroke team and radiology staff is not on-site 24 hours a day. Including radiology staff in the pre-notifications system may help to reduce these delays.

It is important to collaborate with emergency department colleagues to facilitate the availability of well-trained staff and well-rehearsed protocols for thrombolysis. The availability of a rapid response acute stroke team meeting all patients upon arrival can markedly reduce door-to-needle time.[10] Yet, low volumes in smaller hospitals often result in treatment teams less familiar with treatment protocols and resultant delays, especially out-of-hours. Remote expert support through telestroke has been shown to effectively reduce treatment delays and increase treatment rates at smaller hospitals in Australia.[14] A telestroke pilot project is currently underway in the Central Region.

Symptomatic ICH, defined as clinical worsening in the setting of ICH, is the most feared complication of stroke thrombolysis, and occurred in 8 (4.4%) patients. While we cannot conclude with certainty that all symptomatic worsening in these individuals was causally related to the ICH, this rate provides a conservative estimate of potential treatment-related harm, and allows for international comparison. This sICH rate is less than the 6.4% rate reported in the pivotal NINDS,[11] and is comparable to sICH rates reported in other large observational studies conducted in England (4.3–5.8%)[9] and the US (4.7%).[15] There were few other significant complications reported.

Stroke incidence increases with age, and elderly individuals (aged ≥80 years) were proportionately represented in our cohort of thrombolysed patients. While increasing age is associated with poorer stroke outcomes in general, it is reassuring that there was no significant difference in sICH or mortality between >80 and <80-year-olds in our data. This is consistent with the available literature, which indicates that relative and absolute benefits of thrombolysis treatment are maintained in elderly people.[11]

Conclusion

This report provides an overview of the current stroke thrombolysis practices in New Zealand. It demonstrates that New Zealand hospitals achieve an acceptable complication rate by international standards. In addition, the data highlight opportunities for improvement, especially as regards treatment rates and delays and emphasises the importance of on-going data collection to monitor progress.

Competing interests:
Nil
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