

# Delays in hospital admission and investigation in acute stroke

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Delays in admission to hospital and investigation hinder recruitment into trials of acute stroke management. It is therefore important to determine the factors impeding recruitment in stroke trials. The interval between the onset of symptoms and completion of brain computed tomography during a population based study of stroke provided an estimate of the number of patients with stroke who would be suitable for recruitment in clinical trials.

## Subjects, methods, and results

All new stroke events occurring in Auckland residents (total population 945 000) over 12 months were identified. Definitions, sampling, and case finding methods have been reported.<sup>1,2</sup> Stroke events were classified into four categories—subarachnoid haemorrhage, intracerebral haemorrhage, ischaemic stroke, and undefined stroke (symptoms and signs of stroke but no computed tomogram or necropsy report available). The time of onset of stroke was defined as the time when the patient or an observer first noted neurological symptoms or signs. When symptoms were first noticed on awakening the time of awakening was recorded as the time of onset. When the history was unreliable and the patient was alone the time of onset was taken as the midpoint between the time the patient was last seen to be normal and the time the patient was found. The times of seeking medical help, arrival in hospital, and computed tomography were obtained from the medical records or by interviewing the patient.

During the 12 months 1803 stroke events were identified. Of these, 1308 (73%) were managed in a public hospital: 77 subarachnoid haemorrhages (6%), 102 intracerebral haemorrhages (8%), 394 ischaemic strokes (30%), and 735 undefined strokes (56%). The remainder (495) were managed on an outpatient basis or in private geriatric hospitals.

The time between the onset of stroke and arrival in hospital was known for 1008 (83%) stroke events (with exclusion of the 96 strokes that occurred in a public hospital). A total of 216 (21%) patients reached hospital within an hour, 529 (52%) by four hours, 768 (76%) by 24 hours, and 858 (85%) by 48 hours. The median time from the onset of symptoms to arrival in hospital was 3.5 hours (2.0 hours for subarachnoid and intracerebral haemorrhages; 4.3 hours for ischaemic and undefined strokes). The median time to seek medical help was 30 minutes and to reach hospital after seeking help 1.5 hours. For patients with ischaemic and undefined strokes, 164 (19%) reached hospital within one hour, 424 (50%) by four hours, 638 (75%) by 24 hours, and 713 (84%) by 48 hours.

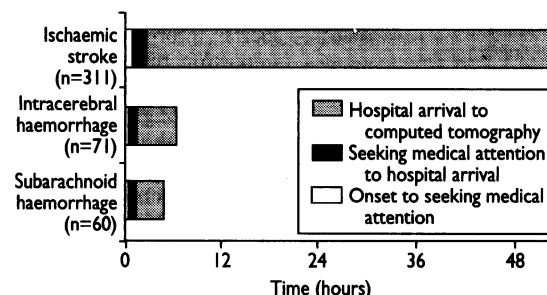
Computed tomography was performed in 545 (42%) hospitalised patients. The time to scanning from the onset of symptoms was available for 442 patients: within one hour in only three patients (1%), within four hours in 48 patients (11%), within 24 hours in 162 patients (37%), and within 48 hours in 231 patients (52%). The median time between the onset of symptoms and scanning was 66 hours in ischaemic strokes, 14 hours in intracerebral haemorrhages, and six hours in subarachnoid haemorrhages. In the ischaemic stroke group (311 patients) computed tomography was per-

formed within one hour in one patient (0.3%), within four hours in 10 patients (3%), within 24 hours in 72 patients (23%), and within 48 hours in 126 patients (41%).

## Comment

Treatment of stroke can be delayed by the time required to reach hospital. Pronounced variations in the delay in reaching hospital have been recorded in other studies.<sup>2,3</sup> Our study probably underestimated the delay before arrival in hospital: when symptoms were first noticed on awakening we took the time of awakening as the time of onset of the stroke. In other studies the midpoint between going to bed and awakening<sup>3</sup> or the time the patient fell asleep<sup>4</sup> have been taken as the time of onset.

Another cause of delay in starting treatment is the time needed to perform investigations. In Auckland fewer than half of the patients admitted to hospital underwent computed tomography. The time required to do the scan was the main cause of delay in starting treatment (figure).



Median times from onset of symptoms to computed tomography by stroke subtype

Recruitment in many acute stroke trials is restricted to patients who are most likely to benefit from the treatment.<sup>5</sup> Trials which exclude patients who have not been admitted to hospital and investigated within a few hours of onset will misrepresent the majority of strokes. The findings of a trial with time limited recruitment cannot be generalised to all patients with ischaemic stroke and the impact of a beneficial treatment will be restricted to a small proportion of patients.

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