Overdiagnosis of TIA and minor stroke: experience at a regional neurovascular clinic

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Summary

We compared the referral diagnoses of TIs and minor strokes made by non-specialists with those of two consultant neurologists, in 565 consecutive cerebrovascular clinic patients, of whom 508 (90%) were referred with a diagnosis of any TIA or stroke. In 373 (73%), the neurologists felt the diagnosis of a cerebrovascular event to be correct. Agreement with the vascular syndrome (CVA vs. TIA) was significantly higher for patients with a referral diagnosis of stroke (136/176) (77%) than it was for patients with a referral diagnosis of TIA (200/332) (60%) (difference in proportions 17%, 95% CI 9–25). In 37 patients (7%) the neurologists confirmed the diagnosis of cerebrovascular disease but not the specific TIA/stroke diagnosis. Vascular surgeons were more likely to be correct in their referral diagnosis of carotid territory cerebrovascular disease (88% correct) than all other sources combined (63% correct) (difference in proportions 25%, 95% CI 11–39), but there was no significant variation in diagnostic accuracy between other individual groups. In 135/508 patients (27%) referred as any TIA or stroke, the diagnosis of cerebrovascular disease was undone. Alternative diagnoses included migraine (3%), epilepsy (1%), hyperventilation (1%), multiple sclerosis (1%) and a case of idiopathic Parkinson's disease, but many symptoms (8%) were unclassifiable.

A strict comparison of diagnostic accuracy would have required assessment of patients not referred for specialist opinion, to estimate false-negative as well as false-positive diagnoses. However, in this patient group (which reflects current local practice) TIs and strokes seem overdiagnosed.

Introduction

It is well known from community- and hospital-based studies that the diagnosis of TIA or stroke brings important implications for the outcome of that patient. For example, a patient having suffered a TIA of the brain or retina is more likely to die from an ischaemic cardiac event than from any other cause. More recently, a number of important trials and overviews directed at prevention of stroke in patients with previous TIs or non-disabling stroke have been published. Implicit in the proven benefit of secondary preventive strategies is that the diagnosis of TIA or minor stroke is actually correct. Thus there are compelling reasons to achieve an accurate diagnostic label— with subsequent implications for prognosis, investigation and therapy.

The diagnosis of a TIA is not always easy. As with other paroxysmal neurological disturbances, it relies solely on the history. Not only must the patient (or witness) be able to provide adequate details but the physician must be able to interpret these correctly. Unlike in patients with established stroke, physical signs to aid the diagnosis are absent. It is our clinical impression, partly supported in the literature, that TIs or 'mild' strokes are overdiagnosed by non-specialists. Given that in the UK the incidence of TIA is 0.4/1000/year the typical general practitioner (GP) should, on average, only see one new case of TIA annually. We therefore analysed our current neurovascular practice to determine what proportion of patients who had been labelled as suffering a TIA...
or stroke had actually suffered a cerebrovascular event.

**Methods**

The Walton Centre for Neurology and Neurosurgery is a regional neuroscience unit. Three consultant-provided neurovascular clinics are held each week. Patients are referred primarily by GPs, general physicians, care of the elderly physicians, vascular surgeons and ophthalmologists. A proportion of cases are referred for tertiary neurological opinions. Approximately 8–10 new patients are assessed per clinic, and appropriate investigations are instigated.

Between March and October 1995, we performed a prospective analysis of 565 consecutive referrals to the neurovascular clinic. Demographic data and details of the referral source were collected. The diagnosis of the referring doctor was noted from the referral letter. Patients were assessed clinically by one of two consultant neurologists with a specialist interest in cerebrovascular disease. Their final diagnosis was documented and, for the purposes of this study and for practical patient management, the neurologists opinion was assumed to be ‘correct’. Only the event(s) that prompted the referral was considered. If a patient had had more than one attack, or different types of attack since the referral was made, the neurologist considered the same episode(s) as the referring practitioner.

We accept the standard definition of a TIA as proposed by Hankey and Warlow:11 ‘an acute loss of focal cerebral or monocular function with symptoms lasting less than 24 hours thought to be due to inadequate cerebral or ocular blood supply as a result of arterial thrombosis or embolism associated with arterial, cardiac or haematological disease’. Symptoms or signs of greater than 24 h duration were labelled as strokes, if due to a vascular cause.

The diagnostic categories of TIA and stroke were subdivided to define the vascular territory—either the carotid or the vertebrobasilar circulation.12 Transient monocular blindness (amaurosis fugax) and dysphasia were considered to be carotid territory symptoms. Occurring in isolation, or together with dysphasia (or rarely amaurosis) we interpreted unilateral sensory/motor symptoms as arising in the carotid territory. Crossed face and limb, or bilateral limb symptoms with or without other features of brainstem or cerebellar disturbance (diplopia, ataxia, hemiparesis) were considered to arise from the vertebrobasilar territory.

If a distinction between the different vascular territories was not stated on the referring letter then the territory was left unspecified. However, in cases where the referring practitioner had defined clearly the symptomatic event (e.g. amaurosis, or transient diplopia, ataxia and hemiparesis) we categorized the territory according to the above criteria. In cases where the neurologist was unable to localize the site of the vascular episode despite a complete history and examination, the vascular territory remained unclassified.

All data were collected contemporaneously with patient assessment. They were sorted using appropriate databases for statistical analysis. Differences between unmatched proportions were determined using confidence interval analysis in the manner of Gardner and Altman,13 significance being assumed at the 95% level.

**Results**

Throughout the 7-month period of study, 565 patients were assessed. There were 308 males (55%) and 257 females (45%) with a median age of 62 years (range 23–94). Referral sources and diagnoses are shown in Tables 1 and 2, respectively. Overall 508 patients (90%) were referred to the clinic with an initial diagnosis of a cerebrovascular episode (any TIA or stroke). In the remaining patients, either no diagnosis was specified (5%), or there were other reasons for referral; for example the assessment of an asymptomatic bruit, or investigation of non-embolic ocular ischaemia.

For the 508 patients referred with a diagnosis of any territory TIA or stroke, the neurologists were in agreement with a cerebrovascular diagnosis in 373 (77%). The proportions for each vascular subgroup are demonstrated in Table 2. Agreement was significantly greater for patients with established strokes (136/176, 77%) than for TIAs (200/332, 60%) (difference in proportions 17%, 95% CI 9–25). There was no significant difference in agreement according to whether the ischaemic episode was in the carotid or the vertebrobasilar territory (283/441, 64% vs. 20/33, 61%, respectively), however the number of patients in the latter group were substantially smaller. In 37 patients (7%) the neurologists confirmed the referral diagnosis of cerebrovascular disease but identified

<table>
<thead>
<tr>
<th>Referral source</th>
<th>n</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Hospital physician</td>
<td>235</td>
<td>42</td>
</tr>
<tr>
<td>General practitioner</td>
<td>143</td>
<td>25</td>
</tr>
<tr>
<td>Neurologist</td>
<td>99</td>
<td>18</td>
</tr>
<tr>
<td>Ophthalmologist</td>
<td>38</td>
<td>7</td>
</tr>
<tr>
<td>Vascular surgeon</td>
<td>33</td>
<td>6</td>
</tr>
<tr>
<td>Other/unspecified</td>
<td>17</td>
<td>3</td>
</tr>
</tbody>
</table>
Overdiagnosis of TIA and minor stroke

Table 2 Referral and neurological diagnoses of 508 patients assessed at the WCNN neurovascular clinic, March to October 1995, who were referred with a diagnosis of cerebrovascular disease

<table>
<thead>
<tr>
<th>Referral diagnosis</th>
<th>Neurological diagnosis</th>
<th>Neurology diagnoses in agreement with referral diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>TIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIA (irrespective of territory)</td>
<td>332</td>
<td>65</td>
</tr>
<tr>
<td>Carotid TIA</td>
<td>282</td>
<td>55</td>
</tr>
<tr>
<td>Vertebrobasilar TIA</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Non-localized TIA</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>Stroke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke (irrespective of territory)</td>
<td>176</td>
<td>35</td>
</tr>
<tr>
<td>Carotid stroke</td>
<td>159</td>
<td>31</td>
</tr>
<tr>
<td>Vertebrobasilar stroke</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Non-localized stroke</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Any TIA or stroke</td>
<td>508</td>
<td>100</td>
</tr>
</tbody>
</table>

* In 15 cases the neurologists agreed with the diagnosis of a TIA but disagreed about the vascular territory.
** In 6 cases the neurologists agreed with the diagnosis of stroke but disagreed about the vascular territory.
*** Includes 37 patients in whom the neurologists relabelled the TIA as a stroke, or vice versa.

the symptomatic event as a TIA rather than a stroke, or vice versa.

Overall, 135/508 patients (27%) referred to the clinic as having suffered a TIA or stroke in any vascular territory were thought not to have had a vascular event at all. In the group referred as carotid territory TIA or stroke, 132/441 patients (30%) were found not to have suffered such events. The neurologists were unable definitely to categorize the patients symptoms in 34 patients (8%) referred as having carotid territory TIs or strokes. Alternative diagnoses in the remainder included vertebrobasilar events (4%), migraine (3%), non-localized vascular episodes (2%), epilepsy (1%), hyperventilation (1%) and multiple sclerosis (1%). In addition there were single cases of syringomyelia, Parkinson’s disease, cervical radiculopathy, retinal detachment, and tension headache within a group of other diagnoses (11%).

Four patients whose referral diagnosis was that of carotid TIA/stroke, but whose neurologists’ diagnosis was in disagreement, were found to have 70% or greater stenosis on duplex ultrasound assessment of the suspected ‘symptomatic’ artery. These four patients may otherwise have been submitted to inappropriate carotid surgery with its attendant hazards. Fifty-four patients were appropriate candidates for carotid endarterectomy according to UK recommendations.

Neurologists’ agreement with the referral diagnosis of carotid territory TIA or stroke was significantly greater for patients referred by vascular surgeons (21/24, 88%) than it was for patients referred from other sources (262/417, 63%) (difference in proportions 25%, 95% CI 11–39). However, such differences in agreement may well be explicable by case mix. There were no significant differences between other individual referring sources.

Discussion

A number of previous studies have described the accuracy of non-specialists in the diagnosis of TIA and stroke.9,10,15 Others have assessed the agreement between different clinicians in deciding whether the event was vascular or not.8,10,12,16 No studies are strictly comparable, due to the different patient populations and referral sources. Community9,10,15 and hospital-based10,16 studies have been reported, and some units have used questionnaires comprising various case scenarios. The present study analyses current routine clinical practice in the UK in a large patient group. We believe it is a true reflection of local practice characteristics and that there are important messages for those either conducting, or referring to, their local cerebrovascular clinic.

The WCNN neurovascular clinic is open to all referral sources, be they primary, secondary or tertiary, thus a broad spectrum of patients are assessed. The availability of the clinic may encourage the referral of patients from non-specialists who ‘might’ have had a TIA or whose diagnosis is uncertain. This may lead to a greater proportion of patients with non-vascular diagnoses in the current series. Nevertheless our proportion of patients who were finally given non-vascular diagnoses (27%) was
actually smaller than other studies—although we also assessed patients with non-disabling completed strokes. If only TIA patients were considered in our study, disagreement with the referral diagnosis was seen in 40%. In the Oxfordshire Community Stroke Project, 9 62% of 512 patients referred by GPs as TIsAAs had non-vascular episodes. In a Spanish community study, 64 of 193 patients (33%) did not have TIsAs when assessed by neurologists 16 and in a Portuguese study, 10 31% and 55% of patients seen by GPs and emergency physicians, respectively, did not have cerebrovascular disorders. Such figures indicate surprisingly poor diagnostic accuracy for what should, at face value, be a seemingly straightforward conclusion to reach. Even among hospital specialists, considerable disagreement may exist regarding what was a vascular event and what was not. 12 Agreement is partly improved by the use of structured history questionnaires 16 and it relies as much on the interpretation of the symptoms as being able to elicit the correct history in the first place. 9

The implications of misdiagnosis are considerable. The diagnosis of a cerebrovascular disorder can imply a limited prognosis. For example, 35% of all deaths within 5 years of a TIA are of cardiac origin, and the risk of death, stroke or myocardial infarction is over 8% per annum. 1 Patients who suffer restricted carotid circulation cortical infarcts (i.e. those which may be labelled ‘mild’ strokes) have a risk of recurrence of 17% in the first year and a risk of death in that year of 16%. 3 The false-positive diagnosis of TIA or stroke thus implies a high risk of future vascular-related episodes, either cardiac or cerebral. In addition, a proportion of patients may be submitted to inappropriate investigations, many of which (e.g. echocardiography or carotid ultrasound) are without hazard but some of which (e.g. carotid angiography) carry significant risks of stroke. 17

Of even greater consequence could be the inappropriate referral of patients for carotid endarterectomy.

Conversely, the false-negative diagnosis of ischaemic carotid territory events could deny patients treatments which are of proven benefit. 4, 5 Such non-diagnosed patients are not referred to this neurovascular clinic, thus we have no idea of the magnitude of this problem. A questionnaire survey of the management of TIsAs by GPs in the Netherlands 18 showed significant cause for concern, in that only 52% of patients were referred for further management (47% to neurologists and 5% to cardiologists). Obviously, the local provision of cerebrovascular services, together with appropriate education, is crucial.

On the basis of the current study, it is impossible to infer any inequality in diagnostic accuracy between different referral sources. Different patient populations are referred, for example, by ophthalmologists compared to vascular surgeons. It is only reasonable to comment that in all groups of referre we were unable to agree with vascular diagnoses in a proportion of patients. We also accept that on occasion the referre may have been correct and it was the neurologist who was fallible. The patient group analysed in this study was clearly influenced by referral bias, and strict comparison of diagnostic accuracy between specialists in cerebrovascular disease and non-specialists would also require an assessment of those patients who were not referred to our clinics in order to estimate false-negative as well as false-positive diagnoses. It seems likely that the latter group would numerically far outweigh the former.

Not surprisingly, the diagnostic accuracy of the non-specialist was greater for strokes than for TIsAAs in our study. Aided by the presence of focal neurological signs and supportive information from neuro-imaging studies, the diagnosis of stroke should be more straightforward. Unfortunately, in the case of TIA patients, there are no definitive investigations. A clearly elicited and correctly interpreted history is crucial for accurate diagnosis. Supportive evidence (vascular risk factors, carotid bruit, ischaemic lesions on neuro-imaging) is often but not invariably helpful.

In a significant proportion of patients (n = 34) the consultant neurologists were unable to formulate a clear diagnosis. In such patients, it is tempting to provide a label for the symptoms (e.g. ‘atypical TIA’), particularly as a patient may find the absence of a definitive diagnosis unsatisfactory. Some patients with definite TIsAs do have atypical symptoms, possibly due to cardiac disease, and although such patients have a lower than expected risk of major stroke, they are at excess risk of a significant cardiac event. 19 Differentiating these patients from those with innocent neurological symptoms is even more difficult, and we expend much energy undoing the diagnosis of cerebrovascular disease in the latter group.

The diagnosis of TIA or minor stroke should be a positive one, based on clearly-defined features in the history, 20-22 and confirmed by clinical signs and neuroimaging evidence in patients with stroke. A negative approach should not be employed, loosely labelling any focal (or even non-focal) paroxysmal neurological disturbance in the at-risk age group as vascular.

References


2. Hankey GJ, Slattery JM, Warlow CP. The prognosis of


Chronic Cough (Chrysanthemum in a bowl)
Aroused Heat *(Hibiscus and velvet)*