TIA in the Swedish Stroke Register (Riksstroke). Aspects on diagnostic validation, risk factors, investigations, and therapies

Buchwald, Fredrik

2018

Document Version:
Publisher's PDF, also known as Version of record

Original Paper

Neuro
epidemiology

Neuroepidemiology 2015;45:40–43
DOI: 10.1159/000437266

Received: May 24, 2015
Accepted: June 26, 2015
Published online: July 22, 2015

Validation of Diagnoses of Transient Ischemic Attack in the Swedish Stroke Register (Riksstroke) TIA-Module

Fredrik Buchwald[a, b] Jakob O. Ström[c] Bo Norrving[a, b] Jesper Petersson[a, b]

[a]Department of Clinical Sciences Neurology, Lund University, Lund, [b]Department of Neurology, Skåne University Hospital, Malmö, and [c]Centre for Health Sciences, Örebro University Hospital, Örebro, Sweden

Key Words
TIA · Diagnosis · Validation · Register

Abstract
Background: In 2010, the Swedish Stroke Register (Riksstroke; RS) established a module for transient ischemic attacks (RS-TIA). We report a diagnostic validation study of patients included in RS-TIA. ***Methods:*** During the first year, 7,825 patients were registered at 59 out of 74 Swedish hospitals. A time-based TIA definition was applied. A sample of 180 patients (30 patients each from 6 hospitals), with a similar distribution of age and sex as in RS-TIA, was prepared. Two independent observers assessed medical records for quality of documentation and assigned a diagnosis of likely, possible, unlikely TIA or ischemic stroke, according to prespecified criteria. ***Results:*** The 2 observers agreed in 77% of cases that the event was a likely or possible TIA, in 3% that the event was an ischemic stroke, and in 2% that the event was an unlikely TIA. The observers disagreed in 8% of patients on TIA vs. ischemic stroke, and in 11% on a vascular vs. non-vascular cause. Quality of documentation was fair. ***Conclusions:*** There was interobserver agreement on diagnosis of TIA in the majority of patients included in RS-TIA. Diagnostic accuracy may be further improved by more systematic documentation of symptoms and signs.

Introduction

Recognition of transient ischemic attacks (TIAs) including urgent evaluation and treatment is crucial for stroke prevention [1, 2]. Diagnosing a TIA, however, remains a challenge and in TIA clinics, only about 50% of patients get a final diagnosis of TIA [3]. TIA criteria exist [4] but are phrased in terms that often do not match the description of symptoms presented to the physician; interobserver agreement is not more than fair [5]. In 2010, the Swedish stroke register (Riksstroke; RS) started a TIA-module (RS-TIA) covering demography, risk factors, ABCD2-score, evaluation, treatment, and follow-up.

The aim of this study was to validate diagnoses in RS-TIA assessing patient characteristics, quality of documentation and interobserver agreement.

Methods

Patients

Between 1 July 2011 and 30 June 2012, 7,825 patients were registered at 59 of 74 Swedish hospitals (1–377 patients per hospital). Six hospitals registered more than 250 patients, 14 hospitals 150–250, and 17 hospitals 75–149. Two hospitals from each of these groups (total 6) were selected on the basis of varying geographical location and size of catchment population. A list of 30 registered

0251–5350/15/0451–0040$39.50/0

E-Mail karger@karger.com
www.karger.com/ned

Fredrik Buchwald, MD, PhD
Department of Neurology
Skåne University Hospital
SE–205 02 Malmö (Sweden)
E-Mail fredrik.buchwald@med.lu.se

patients per hospital (total 180) was prepared at the RS secretariat, creating a simple random sample that was matched by age and sex to the overall population in RS-TIA.

Ethics

Approval of the local ethics committee was obtained (Dnr 2013/719).

Procedure

Respective hospital provided anonymized copies of medical records covering the acute in-hospital stay. A secretary at the study center created 1 record set containing only details on symptoms and signs including clinical examinations, with all other parts censored, and a second set including the complete medical record. Two physicians at 2 separate hospitals performed the assessment independently – 1 house officer with special interest in neurology (investigator A) and one stroke neurologist (investigator B). A prespecified protocol with a 2-step approach was used for evaluation (online suppl. questionnaire, www.karger.com/doi/10.1159/000437266). In step 1 (using first record set), the documentation was evaluated regarding time (duration, onset, resolution), reported symptoms, neurological examination on arrival and follow-up. Assessment was based on NINDS criteria [4] and a time-based TIA definition, that is, an acute focal neurological deficit of presumed vascular origin with complete remission of symptoms <24 h irrespective of neuroimaging findings. Clinical events were assigned 1 of 4 categories: likely TIA, possible TIA, unlikely TIA, or ischemic stroke/retinal infarct (RI). In step 2 (using second record set) data on age, sex, vascular risk factors, history of cerebrovascular events, ABCD2-score, neuroimaging and neurovascular procedures were collected. Missing ABCD2-scores were retrospectively acquired from RS. Presented results on patient characteristics, diagnostic procedures, time aspects and 5 key features of neurological examination – consciousness, speech/language, vision, motor function and sensation – are based on both assessors' findings with post-assessment consensus. In each patient, assessor B identified, if possible, a principal symptom or symptom complex. In cases with multiple symptoms, the leading 1 was identified when possible.

Descriptive and Statistical Analysis

Categorical variables are summarized as proportions and quantitative variables as means. Proportions were derived from the total of patients in whom the respective item was registered. Potential differences were tested by χ^2 testing and Student's t test as appropriate. Interobserver agreement is presented in percentage of agreement and by Cohen kappa statistics (κ) with regard to expected uneven distribution of items. Calculations were performed for the 4 diagnostic categories (likely, possible, unlikely TIA, ischemic stroke/RI) and for likely and possible TIA merged into 1 group. The strength of agreement for κ values are 'poor' (0–0.2), 'fair' (0.21–0.4), 'moderate' (0.41–0.6), 'good' (0.61–0.8), 'very good' (0.81–1).

Results

Patient Characteristics

Baseline data for the study cohort and all patients registered in RS-TIA is shown in table 1. In RS-TIA, ICD-10

Table 1. Comparison of patient characteristics between study sample and RS-TIA

	Study sample (n = 180)	RS-TIA (n = 7,825)	p
Male	56.7 (102)	52.1 (4,079)	ns
Age, mean (range)	76.0 (45–97)	72.9 (15–101)	–
Female		74.4	
Male		71.6	
Medical history			
Hypertension	60.6 (109)	58.6 (4,588)	ns
Diabetes mellitus	12.2 (22)	15.5 (1,211)	ns
Smoking	10.6 (19)	11.5 (902)	ns
Previous stroke	23.9 (43)	19.2 (1,505)	ns
Previous TIA	12.2 (22)	17.7 (1,386)	ns
Atrial fibrillation	23.9 (43)	17.8 (1,391)	0.033
Diagnostic procedures			
CT	97.2 (175)	96.4 (7,542)	ns
MRI	2.2 (4)	8.0 (627)	0.004
Neither CT or MRI	1.7 (3)	2.9 (225)	ns
Carotid ultrasound	55 (99)	60 (4,695)	ns
CT angiography	12.8 (23)	14 (1,098)	ns
Magnetic resonance angiography	0 (0)	2.7 (208)	0.025
No vascular imaging	32 (58)	29.7 (2,323)	ns
Cardiac arrhythmia detection*	96 (172)	45.7 (3,579)	–
ABCD2 score, mean	4.2	4.2	ns

Values are expressed as percentages with numbers in parentheses. ns = Not significant.

* In the study group, a standard 12-channel ECG in-hospital was accepted as cardiac arrhythmia detection; in RS-TIA only continuous cardiac rhythm control in-hospital was registered.

Table 2. Distribution of single or combinations of symptoms in the study sample

Symptoms	% (n)
Motor	25 (45)
Sensorimotor	13.9 (25)
Speech and/or language	12.2 (22)
Speech and/or language and hemisymptoms*	10.6 (19)
Amaurosis fugax	9.4 (17)
Non-focal or not clearly focal symptoms†	8.3 (15)
Isolated diplopia, vertigo or dysarthria	6.7 (12)
Confusion, amnesia and/or loss of consciousness	5.0 (9)
Isolated sensory	3.9 (7)
Isolated homonymous hemianopia	2.8 (5)
Positive visual symptoms	1.1 (2)
Complete blindness	1.1 (2)
Total	100 (180)

* Homonymous hemianopia, unilateral motor or sensory deficit.

† Multiple concomitant symptoms that could not clearly be assigned to a focal vascular territory.

Table 3. Ratings and agreement on TIA diagnosis in the study sample

	Investigator B				
	likely TIA	possible TIA	unlikely TIA	ischemic stroke/RI	total
Investigator A					
Likely TIA	**36.6 (66)**	*10 (18)*	2.8 (5)	0.6 (1)	50 (90)
Possible TIA	*12.8 (23)*	**17.2 (31)**	3.3 (6)	2.2 (4)	35.5 (64)
Unlikely TIA	0.6 (1)	1.1 (2)	**1.7 (3)**	0	3.3 (6)
Ischemic stroke/RI	1.1 (2)	4.4 (8)	2.8 (5)	**2.8 (5)**	11.1 (20)
Total	51.1 (92)	32.8 (59)	10.6 (19)	5.6 (10)	100 (180)

Ratings are expressed as percentages with numbers in parentheses. Bold signals agreements; italics 'likely TIA' vs. 'possible TIA' and normal font disagreement.

diagnosis was G45.9 (unspecified TIA) in 85.3%, G45.1 (carotid artery syndrome) in 7.1%, and other subdiagnoses of G45 in 7.6%. Ninety-seven percent were treated in-hospital with a median stay of 3 days; all 180 study patients were admitted to hospital. Patient characteristics in the study sample were consistent with the total RS-TIA collective except for AF (more frequent), MRI and magnetic resonance angiography (less frequent; table 1). In 57.2% a single symptom or symptom complex was documented. Non-localizing symptoms were reported in 13.3%, that is, loss of consciousness, amnesia, confusion and other non-focal or not clearly focal symptoms (table 2).

Documentation of Time Aspects and Neurological Examination

In 23.3%, neither exact nor estimated duration of symptoms was documented. The mode of onset was documented in 70.6% and mode of resolution in 37.2%. The most frequently documented features of neurological examination on arrival were motor function (92.2%) and consciousness (90.6%), followed by sensory function (66.1%), vision (55.0%) and speech/language (43.9%). All five features were documented in 25.6%, while the ABCD2 score was unrecorded in all cases.

TIA Diagnosis and Interobserver Agreement

In 92.8%, at least one assessor found the clinical event to be a likely or possible TIA. In 76.7%, the assessors agreed that a TIA diagnosis was either likely or possible. They agreed that TIA was unlikely in 1.7% and on a stroke/RI in 2.8%. They disagreed in 18.9% of the patients: in 8.3% on the documented duration (likely TIA/possible TIA vs. stroke/RI) and in 10.5% on a vascular or non-vascular cause (unlikely TIA vs. any other category; table 3). Assessors disagreed on a vascular vs. non-vascular cause in 19 patients. They did not differ in age (77.3 vs. 76.3 years; $p = 0.70$) or ABCD2 score (4.3 vs. 4.2; $p = 0.77$) with the remaining 161 patients. However, in 18 of the 19 patients (95%) at least one assessor rated symptoms as exclusively or partly non-focal vs. 39 of 161 (24%; $p < 0.0001$). Nine of the 19 patients had transient neurological symptoms (TNS) on top of preexisting neurological disabilities (prior stroke, dementia). Positive visual symptoms were reported in 2 cases.

Neuroradiological signs of acute ischemia were visible in a total of 4 patients; in 1 of 4 examined with MRI and in 3 of the ones that underwent CT alone. All these 4 patients were rated by both assessors to have had a likely TIA.

For the categories likely TIA, possible TIA, unlikely TIA and stroke/RI, the κ value of interobserver agreement is 0.326 (SE 0.055). Merging the categories of likely and possible TIA results in a κ value of 0.378 (SE 0.093).

Discussion

Our study on a sample of 180 patients from the Riksstroke TIA-module shows that the 2 independent assessors agreed on a likely or possible TIA diagnosis in 76.7% of patients, including 2.2% with neuroradiological signs of acute ischemia. In 4.4% they agreed on a diagnosis of stroke/RI or that a TIA diagnosis was unlikely. They disagreed in 18.9% of cases due to insufficient documentation of symptom duration or differing opinion on vascular vs. non-vascular cause.

Earlier studies on validation of TIA diagnoses, based on medical record review but with different selection and assessment procedures, have reported positive predictive

values ranging from 28 to 97% [6–10]. In 2 studies monitoring cardiovascular events with relatively low event rates, TIA diagnosis set by treating physicians was confirmed by a review panel in only 28%, respectively [6, 7]. A confirmation rate of 88% was reported from a single-center hospital-based study on TIA diagnosis set on discharge after in-hospital care (n = 263) [8]. In a study on ICD-coding of cerebravascular diagnoses from 3 Canadian hospitals, a trained research assistant confirmed TIA diagnosis in 97% in 1 subset (n = 62) [9]. A validation study of a national stroke register with a similar set-up as ours but a smaller sample (n = 38) resulted in 2 independent assessors confirming TIA diagnoses in 68 and 58%, respectively, with substantial interobserver agreement ($\kappa = 0.75$) on a dichotomized diagnosis (TIA vs. non-TIA) [10].

Symptoms that do not match standardized medical terminology – such as NINDS criteria [4] or typical non-vascular TNS – cause diagnostic uncertainty, as reported even by highly specialized units [2]. In our study, non-focal symptoms were a source of disagreement. However, a substantial number of cases of transient brainstem and visual symptoms that do not meet NINDS criteria may have a vascular cause [11, 12]. More studies of the prognosis of TNS that do not meet TIA criteria but have a possible vascular origin are required.

The large size of a national TIA database was the greatest strength of this study. Potential diagnostic bias was minimized as the 2 experts assessed independently at separate hospitals without reviewing ambiguous cases, and rating of diagnosis was based on symptoms and signs alone. The grade of interobserver agreement was in concordance with prior studies [5].

In conclusion, we found a high rate of agreement on TIA diagnoses, strengthening the validity of RS-TIA. As in previous studies, there was diagnostic uncertainty in some cases but obvious misclassifications were rare. Our results highlight the value of a more systematic documentation of clinical symptoms and diagnostic features of presumed TIAs.

Acknowledgments

The authors thank statisticians Maria Háls-Berglund and Fredrik Jonsson (Riksstroke) and secretary Cecilia Hansson (Neurology Department, Skåne University Hospital) for their dedicated contribution.

Sources of Funding

Grants from Swedish Stroke-Riksförbundet.

Disclosure Statement

No conflicts of interest.

References

1 Rothwell PM, Giles MF, Chandratheva A, Marquardt L, Geraghty O, Redgrave JN, et al; Early use of Existing Preventive Strategies for Stroke (EXPRESS) Study: Effect of urgent treatment of transient ischaemic attack and minor stroke on early recurrent stroke (EXPRESS study): a prospective population-based sequential comparison. Lancet 2007;370:1432–1442.

2 Lavallée PC, Meseguer E, Abboud H, Cabrejo L, Olivot JM, Simon O, et al: A transient ischaemic attack clinic with round-the-clock access (SOS-TIA): feasibility and effects. Lancet Neurol 2007;6:953–960.

3 Cameron AC, Dawson J, Quinn TJ, Walters MR, McInnes GT, Morrison D, et al: Long-term outcome following attendance at a transient ischemic attack clinic. Int J Stroke 2011; 6:306–311.

4 The ad hoc Committee on the classification and outline of cerebrovascular diseases II. Stroke 1975;6:566–616.

5 Castle J, Mlynash M, Lee K, Caulfield AF, Wolford C, Kemp S, et al: Agreement regarding diagnosis of transient ischemic attack fairly low among stroke-trained neurologists. Stroke 2010;41:1367–1370.

6 Ives DG, Fitzpatrick AL, Bild DE, Psaty BM, Kuller LH, Crowley PM, et al: Surveillance and ascertainment of cardiovascular events. The cardiovascular health study. Ann Epidemiol 1995;5:278–285.

7 Holick CN, Turnbull BR, Jones ME, Chaudhry S, Bangs ME, Seeger JD: Atomoxetine and cerebrovascular outcomes in adults. J Clin Psychopharmacol 2009;29:453–460.

8 Ghia D, Thomas PR, Cordato DJ, Worthington JM, Cappelen-Smith C, Griffith N, et al: Validation of emergency and final diagnosis coding in transient ischemic attack: South Western Sydney transient ischemic attack study. Neuroepidemiology 2010;35: 53–58.

9 Kokotailo RA, Hill MD: Coding of stroke and stroke risk factors using international classification of diseases, revisions 9 and 10. Stroke 2005;36:1776–1781.

10 Krarup LH, Boysen G, Janjua H, Prescott E, Truelsen T: Validity of stroke diagnoses in a national register of patients. Neuroepidemiology 2007;28:150–154.

11 Paul NL, Simoni M, Rothwell PM; Oxford Vascular Study: Transient isolated brainstem symptoms preceding posterior circulation stroke: a population-based study. Lancet Neurol 2013;12:65–71.

12 Lavallée PC, Cabrejo L, Labreuche J, Mazighi M, Meseguer E, Guidoux C, et al: Spectrum of transient visual symptoms in a transient ischemic attack cohort. Stroke 2013;44:3312–3317.