EMERGENCY PHYSICIAN'S DIAGNOSIS OF STROKE SUBTYPE

AN ACCURACY STUDY

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ABSTRACT - *Objective:* To evaluate the accuracy of clinical unstructured and structured diagnosis of acute stroke subtypes – cerebral haemorrhage (CH), cerebral infarction (CI), subarachnoid haemorrhage (SAH). *Methods:* Sixty consecutive patients with acute stroke admitted to the Emergency Ward of a Brazilian University Hospital were examined by emergency physicians and computerised tomography (CT). We also compared it (physician's unstructured diagnosis) to two published clinical scoring systems (structured diagnosis - Guy's Hospital and Siriraj Hospital) applied to three other populations – regarding the operational characteristics of the tests. *Results:* In our personal data, among 9 variables that could discriminate CH and CI, three have statistically significant difference (p <0.05): headache (p=0.0002) and vomiting (p=0.02) occurred more frequently in CH patients, but previous stroke in those with CI (p=0.04). Unstructured diagnosis proved valid for SAH, with a +LHR= 39.7; and to a smaller degree for CI (-LHR= 0.1). However, it exhibited low sensitivity for the diagnosis of CH. Structured tests (Guy's Hospital and Siriraj Hospital) also failed to confidently diagnose stroke subtypes, especially CH. *Conclusions:* Both clinical diagnosis (made by emergency physicians) and the available diagnostic tests fail to confidently discriminate CH and CI.

KEY WORDS: cerebrovascular disease, diagnosis, medical education.

Diagnóstico dos subtipos de acidente vascular cerebral: um estudo de acurácia com médicos de emergência

RESUMO - *Objetivo:* Avaliar a acurácia do diagnóstico clínico não estruturado e do estruturado dos subtipos do acidente vascular cerebral (AVC): hemorragia cerebral (HC), infarto cerebral (IC), hemorragia subaracnóide (HSA). *Método:* Sessenta pacientes com AVC consecutivamente admitidos em emergência de hospital universitário brasileiro foram examinados por médicos da emergência e por tomografia computadorizada (TC). Nós também comparamos isso (diagnóstico clínico não estruturado) com os resultados de dois testes diagnósticos estruturados sobre AVC da literatura (Guy's Hospital e Siriraj Hospital) aplicados a três outras populações – com atenção às características operacionais dos testes. *Resultados:* Em nossos dados pessoais, entre nove variáveis que poderiam discriminar HC e IC, três apresentaram diferenças significantes estatisticamente (p<0.05): cefaléia (p=0.0002) e vômito (p=0.02) ocorreram mais frequentemente naqueles com HC, mas AVC prévio naqueles com IC (p=0.04). Diagnóstico não estruturado mostrou-se válido para HSA, com +LHR= 39.7; e em menor grau para IC (-LHR= 0,1). No entanto, ele exibiu baixa sensibilidade para o diagnóstico de HC. Testes estruturados (Guy's Hospital and Siriraj Hospital) também falharam para o diagnóstico seguro dos subtipos de AVC, especialmente da HC. *Conclusão:* O diagnóstico clínico (feito por médicos de emergência) e os instrumentos diagnósticos estudados não diferenciam de modo confiável HC e IC.

PALAVRAS-CHAVE: doença cerebrovascular, diagnóstico, educação médica.

The diagnosis of the acute stroke syndrome is considered highly specific, even more with the aid of computerized tomography (CT)[1]. The false-positive rate without ancillary investigation is 1-

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5%[2], diagnostic errors being most likely in patients with malignant tumours and subdural bleeding[3]. However, diagnosis of stroke subtype is considered less accurate. The distinction between cerebral infarction (CI) and intracerebral haemorrhage (ICH) is now seen as crucial in determining prognosis and acute care and to promote secondary stroke prevention. Certain drugs or procedures may benefit patients with CI but they are potentially dangerous in those with haemorrhage. The classic clinical features of ICH (sudden onset with severe headache, rapid deterioration of consciousness, lack of previous transient events) are frequent and reasonably specific only in massive haemorrhage. However, distinction between CI and small or superficial haemorrhages using these simple criteria seems to be considerably more difficult. To deal with this problem, clinical scoring systems including several variables have been constructed and are considered to be more accurate than unstructured clinical diagnosis as usually made in clinical practice. Instruments commonly used for this purpose include those from the Guys Hospital[2], from Siriraj Hospital[4] and from the Grenoble University Center[5].

In many hospitals, emergency ward physicians are the first to examine acute stroke patients. We conducted a study comparing the accuracy of the diagnosis of the acute stroke syndrome and its subtypes as made by general physicians working in an emergency ward of a University Hospital or diagnostic score systems. Diagnosis based on clinical and CT data analysed by two neurologists experienced in the management of stroke was used as a reference standard.

SUBJECTS AND METHODS

The present cross-sectional study is based on prospectively collected data and was carried out at the emergency ward of a 500-bed University Hospital from May 1992 until May 1993. Patients were consecutively seen, no more than two days after symptom onset, and were included if they had clinical evaluation, an inhospital CT made shortly after admission, and enough data in relation to the variables studied.

Stroke was defined as focal cerebral dysfunction of acute onset and lasting more than 24 h or leading to death, with no apparent cause other than of vascular origin[6]. Diagnosis of stroke subtype was compared with final diagnosis based on clinical and CT findings analysed by two neurologists (MFC and CA). Sixty patients were studied for accuracy of stroke subtype diagnosis (two cases of subdural haematoma incorrectly diagnosed as CI were excluded). CT was routinely performed in a Somaton DR-2 equipment (Siemens, 256x256 pixels), with 4 mm (posterior fossa) and 8 mm slices. The likelihood ratios (LHR) of the clinical diagnosis based on this first evaluation and on the Guy's Hospital and Siriraj's Hospital scoring systems[3,4] in the original settings and in Glasgow[7] were compared. Predictive characteristics of the clinical scoring systems were based on given or calculated sensibility and sensitivity: (+)LHR= sensibility/ (1-especificity); (-)LHR= (1-sensibility)/especificity). Jaeschke and col.[8] considered that the LH values > than 10 or less than 0.1 generate conclusive changes from pretest to post-test probability. These criteria were considered in the present study. The Grenoble test[5] did not provide enough data for the calculations of the likelihood ratios, which are of primordial importance for the proposed evaluation[9].

RESULTS

Sixty-two patients were studied. Final diagnosis was CI in 34, ICH in 17, subarachnoid haemorrhage (SAH) in 9, and subdural haematoma in 2. Table 1 shows the characteristics of the sample.

A univariate analysis of nine variables that might differentiate infarction from hemorrhage was done (Table 2). Headache, vomiting and a history of previous stroke helped in the differentiation between ischaemic and haemorrhagic stroke. Multivariate analysis was not performed because of the small sample size.

Table 3 presents the characteristics of the unstructured diagnostic test, and Table 4 summarizes it and also the performance of two scoring systems, Guy's Hospital and Siriraj's Hospital, applied to three populations. Unstructured diagnosis proved valid for SAH, with a +LHR= 39.7; and to a smaller degree for CI (-LHR= 0.1). However it exhibited low sensitivity for the diagnosis of CH. Structured tests also failed to confidently diagnose stroke subtypes, especially CH (Table 4).

Table 1. Distribution of demographic characteristics in different stroke subtypes.

Stroke subclassification	Age		Gender		Total
	mean (sd)	p value*	male n%	female n%	n%
Cerebral infarction	65.8 (15.2)	0.03	17 (59.4)	17 (53.6)	34 (56.7)
Primary intracerebral Haemorrhage	56.3 (13.9)		9 (28.1)	8 (28.6)	17 (28.3)
Subarachnoid Haemorrhage	48.1 (10.8)		4 (12.5)	5 (17.8)	9 (15)

* ANOVA (cerebral infarction differs from subarachnoid haemorrhage).

Table 2. Univariate analysis of 9 variables that might distinguish cerebral infarction and cerebral haemorrhage.

	Infarction (n=34)	Haemorrhage (n=17)	p value *
Headache	5	11	0.0002
Vomiting	3	6	0.02
Previous stroke	16	3	0.04
Loss of consciousness	6	7	0.07
Babinski sign	17	13	0.07
Hypertension	9	8	0.14
Motor deficit			
1	2	3	
2 + 3	20	8	
4	12	6	0.38
Diabetes or coronary artery disease	14	5	0.41

*Qui-square or Fisher's exact test.

Table 3. Validity of the unstructered clinical diagnosis compared with CT (n=60, including subarachnoide hemorrhage).

Clinical Diagnosis	CT Diagnosis	
	Cerebral infarction	Other
Cerebral infarction	32	11
other	2	15

Results: sensitivity=94,1 specificity=57,7 +LHR=2.2 -LH=0.1
(CI= 80.32-99.28) (CI 36.92-76.65)

Clinical Diagnosis	CT Diagnosis	
	Intracebral hemor.	Other
Intracebral hemor	7	2
other	8	41

Results: sensitivity=41.2 specificity=95.3 +LHR=8.9 -LH=0.6
(CI= 80.32-99.28) (CI 36.92-76.65)

Clinical Diagnosis	CT Diagnosis	
	Subarachn. Hemor.	Other
Subarachn. Hemor.	7	1
other	2	50

Results: sensitivity=77.8 specificity=98.0 +LHR=39.7 -LH=0.2
(CI= 80.32-99.28) (CI 36.92-76.65)

Table 4. Operational characteristics of clinical diagnosis of stroke subtypes made by emergency medicine physicians and stroke classification systems*.

	Sensibility	Specificity	(+) LHR	(-) LHR
Brazilian university hospital				
(Unstructured Diagnosis)				
Cerebral infarction	94%	58%	2.2	0.1
Primary intracerebral haemorrhage	41%	95%	8.9	0.6
Subarachnoid haemorrhage	78%	98%	39.7	0.2
Guy's Hospital Score				
(thirteen variables included)				
Cerebral infarction (2)	82%	93%	11.7	0.19
Primary intracerebral haemorrhage (2)	93%	82%	5.18	0.09
Primary intracerebral haemorrhage (7)	93%	82%	5.18	0.09
Siriraj's Hospital Score				
(five variables included)				
Cerebral infarction (4)	95%	76%	4.0	0.07
Primary intracerebral haemorrhage (4)	76%	95%	15.2	0.25
Primary intracerebral haemorrhage (7)	76%	95%	15.2	0.25

*Cut-off point defined in each study by means of a ROC curve.
 (2) in Guy Hospital – UK; (4) in Siriraj Hospital – Thailand; (7) Glasgow - UK.

DISCUSSION

Diagnosis of the acute stroke syndrome is relatively easy, but diagnosis of stroke subtype in the acute setting is certainly difficult. The sample in this study was restricted to cases of definite stroke, as in other studies concerning structured diagnosis[3,8-10]. The prevalence of haemorrhagic stroke in our sample (33%) was higher than in the United Kingdom (18%) and smaller than in Thailand (69%). These differences may explain the different operational characteristics of the tests according to the population to which the clinical scoring systems were applied. Differences in stroke severity also must be considered: strokes were more likely to be severe in patients from Thailand and milder in British patients than in Brazilian patients.

The unstructured clinical diagnosis (emergency ward physician's diagnosis) proved accurate mainly for the diagnosis of SAH, but less so for CI and especially for ICH. The diagnostic scores did not prove more accurate than unstructured clinical diagnosis (mainly in relation to the CH).

The objective of an educational policy is to improve accuracy in diagnosing the acute stroke syndrome based on clinical variables at the bedside: simple, reliable, and safe diagnostic model as compared with others, highly elaborate instruments in biomedical sciences. This probabilistic diagnostic approach has to be considered and it is very important, but the clinical reasoning has other components, such as the causal reasoning, and the deterministic reasoning, as mentioned by Kassirer, 1989[10].

In conclusion, the use of systematic diagnostic approaches such as those here evaluated is worthwhile as a screening procedure if there is not a proved specific therapy available. Our study shows, however, that these clinical scoring systems do not exhibit enough accuracy to be applied safely if the use anticoagulant or thrombolytic therapy should be considered, and their strict use may in fact prove dangerous if neuroimaging techniques are not routinely required.

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