MATTERS ARISING

Predicting the outcome of acute stroke

The multivariate models examined by Gladman, Harwood and Barer predicted death within three months of a stroke with an accuracy of only 50–75%.¹ It should be emphasised, however, that these models were not designed to predict mortality at three months; the Uppsala and Belfast models were designed to predict mortality at one and six months respectively, and the Guy's Hospital Prognostic Score was designed to predict death or functional dependence at two months. We have used data from an unselected cohort of patients registered with the Oxfordshire Community Stroke Project (OCSP)² to examine the utility of the Guy's score in predicting severe functional dependence or death at one and six months after a first stroke. For this analysis a modified Rankin grade³ of 4 or 5 was taken to indicate severe functional dependence.

When applied to the 165 patients registered in the final year of the OCSP, when the relevant data items were collected, the Guy's score predicted severe functional dependence or death one month after the stroke with a specificity of 99% and a sensitivity of 34% (predictive accuracy 77%). A modified version of the score which omitted one clinical feature, loss of consciousness at onset, but could be tested on the whole cohort of 675 patients, performed with a similar accuracy (table 1). With the sensitivity of the modified score equal to that of impaired conscious level (unconscious or drowsy at 24 hours), the likelihood ratio of the modified score (8.0) exceeded that of impaired conscious level (5.5), suggesting that when used to predict both functional dependence and death, the Guy's score did provide additional prognostic information.

The clinical usefulness of the Guy's score may, however, be limited. The calculation was laborious and the score required the identification of higher cerebral dysfunction which was difficult in acute stroke patients. A single clinical feature, such as, impaired conscious level might therefore be preferred. In this analysis urinary incontinence

Table 2 Predictors of death or dependency six months after stroke.

	Sensitivity	Specificity	Positive PV	Accuracy	Likelihood ratio
Drowsy/unconscious on Day 1	55%	81%	77%	67%	2.9
Incontinent of urine on Day 1	83%	65%	74%	75%	2.4
Drowsy/unconscious and incontinent on Day 1	52%	86%	81%	68%	3.7

(or the use of a urinary catheter), occurring between the time of the stroke and the examination by the study neurologist (median 4 days), was the most accurate predictor of a poor outcome (table).

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- 1 Gladman J, Harwood D, Barer D. Predicting the outcome of acute stroke: prospective evaluation of five multivariate models and comparison with simple methods. *J Neurol Neurosurg Psychiatry* 1992;55:347–51.
- 2 Bamford J, Sandercock P, Dennis M, et al. A prospective study of acute cerebrovascular disease in the community: The Oxfordshire Community Stroke Project 1981–1986. 1. Methodology, demography and incident cases of first-ever stroke. *J Neurol Neurosurg Psychiatry* 1988;51:1373–80.
- 3 Bamford J, Sandercock P, Warlow C, Slattery J. Interobserver agreement for the assessment of handicap in stroke patients. *Stroke* 1989;20:828.

Gladman et al reply:

We agree with the comments of Drs Burn and Sandercock on our paper. The diversity of clinical measures required by the models we examined forced us to modify the predicted outcomes in some cases, to make comparisons. This did not significantly affect our overall conclusions and the Oxfordshire Community Stroke Project (OCSP) results appear to confirm this. It is not surprising that the Guy's score was slightly better at predicting bad outcome (death or dependency) than conscious level alone as the latter variable forms part of the Guy's model. As Burn and Sandercock point out, the extra effort in collecting the other data needed for the model and calculating the score is probably not justified by the practical gain.

The OCSP data also confirm, once again, the pre-eminence of continence as a predictor of functional outcome. If any addi-

tional information is required to modify the over-pessimistic forecasts of impaired conscious level alone, continence is the obvious choice. In our study we did not routinely collect information on continence on day 1 but we are able to test our proposal on an independent set of nearly 400 hospitalised stroke patients in whom this information was available.

Table 2 shows the accuracy of various predictors of death or dependency at six months (54% of the whole patient group). Thirteen per cent of drowsy patients were continent on day 1 and these were subtracted from the "bad prognosis" group to form a combined predictor (impaired conscious level and incontinent) with a likelihood ratio of 3.7 compared with 2.9 for impaired conscious level alone, and 2.4 for incontinence alone. A more elaborate combined scale involving different degrees of impaired consciousness and incontinence could also be constructed and might further improve predictive accuracy.

The practical value of all these predictive models and variables depends on the situation. Prognostic stratification is certainly important for clinical trials (and it may be impractical to use continence as a guide when very early medical intervention is required) and a simple system of "triage" may help in the efficient organisation of stroke services. We still maintain, however, that the modest gains in predictive accuracy provided by multivariate models are of negligible value in guiding the management of individual patients.

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Hypergraphia and brain damage

We wish to comment on the paper by Imamura et al¹ on hypergraphia and brain damage, to show that hypergraphia can also be an uncommon symptom of a dementia of frontal type.

A 60 year old policeman with a positive family history for dementia came to our attention in 1991 with a severe cognitive impairment. He first had difficulty in drawing schemes of car accidents nine years previously, and this was soon followed by personality and behaviour disturbances such as disinhibition, aggressive behaviour, impulsivity, emotional lability. The following few years he developed word finding problems, gluttony, ritualistic behaviour, hoarding of objects, decreased speech output, verbal stereotypes, paraphasias and mild memory loss. In 1987 the patient could still drive his own car without getting lost and the other main activities of daily living were only mildly affected.

In 1986 he started compulsively writing his own signature filling some 1500 sheets

Table 1 The positive predictive value and predictive accuracy of the Modified Guy's Hospital Prognostic Score and various single clinical features in predicting death/severe functional dependence at one and six months after a first stroke.

	Positive Predict Value		
	Death 30 days	Death/Functional Dependence 1 month	Death/Functional Dependence 6 months
Modified Guy's Score*	51%	85%	88%
Unconscious	75%	93%	92%
Unconscious/Drowsy	50%	79%	73%
Incontinent/Catheterised	47%	95%	85%
	Predictive Accuracy		
	Death 30 days	Death/Functional Dependence 1 month	Death/Functional Dependence 6 months
Modified Guy's Score*	81%	77%	81%
Unconscious	86%	59%	69%
Unconscious/Drowsy	81%	75%	74%
Incontinent/Catheterised	85%	88%	83%

*Cut off score: –2.5.