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Prediction of Spontaneous Intracerebral Hemorrhages Outcome

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Abstract: Spontaneous Intracerebral Hemorrhage (SICH) is associated with the highest mortality of all cerebrovascular events and most survivors never regain functional independence. This study was to determine potential predictors of good outcome in SICH which could be useful for selecting patients for surgical procedures. Fifty four patients with spontaneous hemispheric ICH were nonsurgically treated and were admitted consecutively to the neurology service. Hematoma volume was measured on Computed Tomography (CT) at admission. Stroke severity was assessed by the Glasgow Consciousness Scale (GCS). Good outcome was defined as Glasgow Outcome Scale (GOS) 3-5 at 30 days. At the end of the follow up period, 25 patients (46.3%) had good outcome. GCS, papillary reaction abnormalities and hemiparesis were significantly associated with good outcome in bivariate analyses. Of the initial CT scan variables, larger volume of the ICH, larger volume of peripheral hypodensity, intraventricular spread of bleeding and mass effect were related to poor outcome. On multiple logistic regression analysis, GCS ($p = 0.001$) and ventricular extension ($p = 0.004$) were independent predictors of good outcome. These 2 factors correctly classified 85.2% of patients. Good outcome in SICH can be predicted on admission by 2 readily assessable factors (GCS score and ventricular extension). These predictors may be helpful in selecting patients for surgical treatment.

Key words: Spontaneous intracerebral hemorrhage, predictors, outcome

INTRODUCTION

Spontaneous Intracerebral Hemorrhage (SICH) was defined as supratentorial intracerebral hemorrhage without previous trauma or proven cause of bleeding. SICH accounts for approximately 10-15% of all strokes and is associated with a high mortality and morbidity. Between 32 and 50% of patients die within the first month. One-half of these deaths occur within the first 2 days and only 20% are independent 6 months after intracerebral bleeding. Despite the seriousness of the condition, the best therapeutic option for patients suffering from spontaneous supratentorial ICH remains to be established. Several clinical and radiological factors such as age, level of consciousness, hypertension, volume of the hematoma, volume of peripheral edema, midline shift displacement on initial Computed Tomography (CT) and intraventricular spread of the bleeding appear to be markers of poor prognosis after spontaneous ICH. However, only a few studies have attempted to identify factors related to a favorable functional outcome in patients suffering from spontaneous supratentorial ICH. Our aim in the present study was to investigate easily identifiable predictors of a good outcome in spontaneous supratentorial ICH, suitable for selecting patients who might benefit from surgical procedures while avoiding the harmful effects of surgery in those with potential for spontaneous recovery.

MATERIALS AND METHODS

According to our stroke protocol, all suspected stroke patients are admitted to our neurology service and they undergo Computed Tomography (CT) scan of the brain within 2-3 h of admission. Consecutive patients admitted from 1 October 2007 to 1 June 2008 with intracerebral hemorrhage were included in the study. Patients with preexisting neurological deficits, e.g., AVMs, aneurysms, previous intracerebral hematoma or infarct, or neurological disease, like Parkinson's disease, patients with life-threatening disease, like malignancies and patients with bleeding disorders or on anticoagulants were excluded.

We recorded patients' prehospital neurological status and neurological status on admission. The following details were obtained: Glasgow Consciousness Scale (GCS), papillary reaction abnormalities and evidence of hemiparesis.

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The CT images were reevaluated and the hematomas were classified by location (thalamic, basal ganglia and lobar).

According to Glasgow Outcome Scale (GOS), outcome at 30 days was determined as GOS 1 = dead; GOS 2 = persistent vegetative state; GOS 3 = sever disability; GOS 4 = moderate disability; GOS 5 = good recovery. For statistical analysis, outcome was dichotomized into: GOS 1-2 = unfavorable outcome and GOS 3-5 = favorable outcome.

Nominal data were analyzed using chi-square test. For numerical data like age and hematoma volume, t-test was used. Logistic regression analysis was employed to find the best predictive model of good outcome.

RESULTS

A total of 54 patients recruited for this study. There were 26 men and 28 women. Their ages ranged from 37-91 years (mean 68 years). Thirty five patients (65%) had the history of Hypertension. Hemiparesis was present in 45 cases (83.3%). Papillary reaction abnormalities were seen in 19 patients (35.2%). The mean systolic blood pressure was 200±40 and the mean diastolic blood pressure was 104±17.

About 54 patients studied, 25 (46.3%) had a good outcome at 30 days, 29 (53.7%) had unfavorable outcome 1 patient was in vegetative state and 28 died. Table 1 summarizes the main characteristics of the population studied.

Among the radiological variables, larger volume of the ICH, larger volume of peripheral hypodensity, intraventricular spread of bleeding and mass effect were significantly related to poor outcome, whereas the location of hematoma did not differ between the 2 groups of patients.

In the logistic regression analysis, papillary reaction abnormalities, hemiparesis, ICH volume, midline shift and volume of peripheral hypodensity were eliminated by both forward and backward stepwise variable selection. Inclusion of age, sex and history of hypertension provided no additional discriminative information. The significant factors in the model were the GCS ($p = 0.001$) and ventricular extension ($p = 0.004$). Patients without ventricular extension were almost 5 times more likely to have good outcome than patients with ventricular extension and after adjustment for the best predictive model, sensitivity of the model for predicting a good outcome = 88%, specificity = 82.8%, overall probability of being correct = 85.2%.

Table 1: Clinical characteristics and radiological variables in patients with good and poor outcome

Variable	GOS 1-2 (n = 29)	GOS 3-5 (n = 25)	p-value
Male sex	13(44.8%)	13(52.0%)	0.4000
Age(years, mean)	65.3	70.1	0.1720
History of HTN	21(72.4%)	14(56.0%)	0.1650
GCS (mean)	7.3	12.8	<0.0001
Headache	11(37.9%)	8(32.0%)	0.4340
Vomiting	15(51.7%)	12(48.0%)	0.5000
Hemiparesis	21(72.4%)	24(96.0%)	0.0220
Papillary reaction abnormalities	16(55.2%)	2(8.0%)	<0.0001
Systolic BP (mm Hg)	198.0	201.0	0.8160
Diastolic BP (mm Hg)	101.0	108.0	0.1130
Thalamic	10(34.5%)	5(20.0%)	0.1900
Basal ganglia	11(37.9%)	16(64.0%)	0.0500
Lobar	8(27.6%)	4(16.0%)	0.2460
Hematoma volume (mL, mean)	44.7	18.1	0.0020
Midline shift (mm, mean)	5	0.7	<0.0001
Volume of peripheral hypodensity (mL, mean)	16.1	5.4	0.0260
Ventricular extension	21(72.4%)	4(16.0%)	<0.0001

HTN: Hypertension, GCS: Glasgow Consciousness Scale, BP: Blood Pressure

DISCUSSION

Until recently, no therapies for ICH have shown benefit in randomized clinical trials, including surgical evacuation, osmotic diuretics, glucocorticoids, glycerol and hemodilution. The general management of ICH is similar to that of any acute focal brain injury and is aimed at complications such as increased intracranial pressure, mass effect and secondary infections (Broderick, 1994; Zuccarello *et al*., 1999; Lisk *et al*., 1994).

Some studies have reported a lack of efficacy of surgical evacuation (McKissock *et al*., 1961; Juvela *et al*., 1989; Batjer *et al*., 1990; Morgenstern *et al*., 1998) whereas others have shown lower mortality in patients who underwent surgical removal of blood (Auer *et al*., 1989). Therapeutic strategies should be based on the prediction of the natural evolution of the ICH. Predictive models of mortality and morbidity, based on clinical and radiological variables, have already been developed in patients with spontaneous ICH (Qureshi *et al*., 1995; Kase and Crowell, 1994; Fieschi *et al*., 1988; Portenoy *et al*., 1987; Daverat *et al*., 1991; Counsell *et al*., 2002; Flemming and Wijdicks, 2001; Longo-Mbenza *et al*., 2000; Gebel *et al*., 2002). Mortality, at 30 days is correctly predicted in 85-95% of patients by assessing the Glasgow Coma Scale (GCS) score and intraventricular spread of the bleeding (Tuhrim *et al*., 1988, 1991; Broderick *et al*., 1993). The 2 variables selected by the model are easy to collect and clinically relevant (Kwakkel *et al*., 1996; Laupacis *et al*., 1997).

The ability to predict the outcome of patients with spontaneous supratentorial ICH may improve the management of these patients. Where a good prognosis is identified, patients could be spared the potential risk of

surgical interventions and more accurate information could be given to the patients and their relatives. Finally, a predictive model in these patients may be a powerful tool for use in the selection of patients for clinical trials, avoiding the enrolment of those, who could obtain no benefit from the procedure under investigation.

CONCLUSION

We have developed a simple and easy to use model for predicting a good outcome in patients with spontaneous supratentorial ICH. The accuracy of our model needs to be assessed by external validation with an independent prospective sample of similar patients.

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