SHORT REPORT

Prognostic value of the amount of post-traumatic subarachnoid haemorrhage in a six month follow up period

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Abstract

Clinical and radiological patterns from 148 patients with post-traumatic subarachnoid haemorrhage (TSAH) were analysed with specific regard for the amount and distribution of blood in subarachnoid spaces to verify if these variables have any influence on overall outcome. The degree and extent of TSAH were classified according to Fisher's criteria: in 93 patients it was grade 1, in 36 grade 2, in 13 grade 3, and in six grade 4. There was a significant correlation between increasing clinical severity at admission and the amount of subarachnoid bleeding and a direct relation between a favourable outcome and a low Fisher grade. The distribution of subarachnoid blood was not significantly related to clinical condition at admission, whereas the pattern had a significant impact on the outcome. The results of the present study confirm that TSAH is a negative prognostic factor. Whereas the degree of TSAH is mainly related to clinical conditions at admission, the presence of subarachnoid blood clots both in basal cisterns and over the cerebral convexity indicates a poor outcome.

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Keywords: traumatic subarachnoid haemorrhage; prognostic factors; degree of subarachnoid haemorrhage

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It is difficult to calculate the real incidence of post-traumatic subarachnoid haemorrhage (TSAH): the medical literature reports that 25–30% of patients with either moderate or severe head injury present signs of subarachnoid bleeding.[1–2] Eisenberg *et al*,[3] in a large series of 753 patients, reported that patients presenting with TSAH on CT had a twofold higher risk of mortality and that TSAH was directly related to increasing intracranial pressure. In a recent study,[2] 60% of patients with TSAH had an unfavourable outcome compared with 30% in the absence of TSAH, and, moreover, TSAH has been significantly associated with skull fractures and cerebral contusions.[4]

The impact of different degree and location of subarachnoid clots at follow up of patients has, however, scarcely been investigated: in the present study we have investigated the correlation between the distribution and degree of TSAH with the clinical features and outcome in a series of 148 patients.

Materials and methods

In the period 1 January 1992–31 March 1994, 515 patients required admission to the neurosurgical department for head injury: in all cases they underwent diagnostic CT and a recent review of clinical records and CT performed at admission disclosed the presence of TSAH in 148 (28·7%) of cases. To assess the grade of subarachnoid bleeding Fisher's criteria[5] were adopted by a panel of neurosurgeons (PG, GB, RRB), which reviewed all CT. The distribution of subarachnoid bleeding and the presence of associated lesions were considered separately: we distinguished patients with predominant diffuse subarachnoid bleeding over the convexity, patients with blood in basal cisterns, and patients with a mixed pattern of TSAH. The following variables for each patient were also recorded: sex, age, Glasgow coma scale (GCS) at admission; and the outcome at six month follow up by the Glasgow outcome scale (GOS) criteria with a clinical visit or phone interview of patients or relatives. For statistical analysis we considered three different GCS subgroups: mild (GCS 13–15), moderate (GCS 8–12), and severe (GCS 3–7).

Statistical analysis was performed to determine if there was any prognostic factor related to TSAH, either positively or negatively, with special regard for the amount and distribution of subarachnoid blood: the relations between Fisher grade at CT, GCS, and GOS were evaluated by multiple logistic regression, contingency tables, and χ^2 test in a statistical package for Apple Macintosh (Estatix and Statworks programs).

Results

Among the 148 patients with signs of TSAH, 121 (81·8%) were male and 27 (18·1%) were female. Mean age was 50·6 (SD 1·86) (range 12–89) years with a median of 54 years. The GCS mean value at admission was 9·3 (SD 0·35) with a median of 10. Sixty three

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Relation between location of subarachnoid bleeding and outcome at six month follow up

TSAH distribution	*Favourable outcome (n)*	*Unfavourable outcome (n)*	*Total n (%)*
Spaces over cerebral convexity	54	37	91 (61·5)
Basal cisterns	19	17	36 (24·3)
Mixed distribution	4	17	21 (14·2)
Total (%)	77 (52·03)	71 (47·97)	148

Favourable outcome = complete recovery and moderately disabled; unfavourable outcome = severely disabled, vegetative, or dead; χ^2 11·110; contingency coefficient = 0·264; P = 0·004.

patients (42·6%) had a GCS at admission between 3 and 7 points, 37 (25%) between 8 and 12, and 48 (32·4%) between 13 and 15. Examination by CT at admission excluded associated intracranial lesions in 37 patients (25%); 93 patients presented with TSAH associated with cerebral contusion alone or with other intracranial lesions; in 18 patients (13·8%) TSAH was associated only with subdural or extradural haematomas. When the intracranial complication was considered as a single variable, this was not significantly related to GCS at admission (χ^2 6·206; P = 0·184), or with GOS at a six month follow up examination (χ^2 13·299; P = 0·102).

At a six month follow up examination 77 patients (52·1%) were classified with favourable outcome (good recovery and moderately disabled), and 71 patients (47·9%) presented an unfavourable outcome (severely disabled, vegetative, or dead); overall mortality in the six month period was 24·3% (36 patients) (table).

The degree and extent of subarachnoid haemorrhage were classified according to Fisher's criteria: in 93 patients (62·8%) TSAH was classified grade 1; in 36 patients (24·3%) grade 2; in 13 patients (8·8%) grade 3, and in six patients (4·05%) grade 4.

The distribution of subarachnoid blood was as follows: 91 patients (61·5%) presented with diffuse bleeding in subarachnoid spaces over the cerebral convexity; in 36 patients (24·3%) blood was evident in basal cisterns, and in 21 patients (14·2%) a mixed pattern of TSAH was shown. The degree of TSAH was not significantly related to the age or the sex of the patients.

There was a significant correlation between a favourable outcome and a low Fisher grade (figure, A) and increasing clinical severity at admission and the amount of subarachnoid bleeding (figure, B).

There was no significant correlation between the amount of blood in subarachnoid spaces and its location: 71·4% of patients with blood in subarachnoid spaces over the cerebral convexity and 69·4% of those with blood in the basal cisterns were classified as Fisher grade 1.

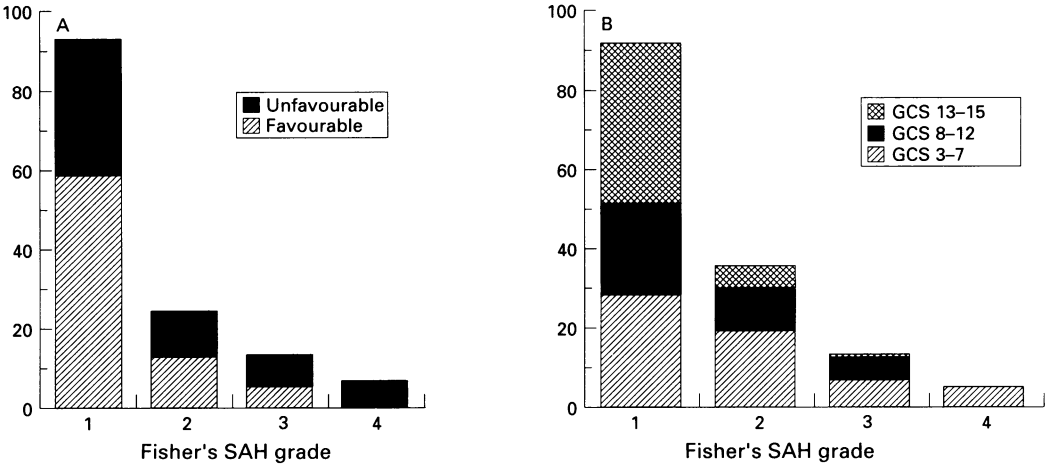
When GCS groups (mild, moderate, and severe) and GOS groups (favourable and unfavourable) were considered together as independent variables, the relation with TSAH distribution was not significant (F = 5·761, F required at 99·9% level of significance = 11·276), whereas if GCS and GOS groups were considered separately as independent variables, only the relation between GOS and TSAH distribution reached significance (F = 11·277, P = 0·001).

Discussion

The results of the present study confirm that TSAH itself has a negative clinical significance in cases of head injury and suggest that the amount and distribution of subarachnoid bleeding have a prognostic impact: GCS at admission is significantly related to degree of TSAH (χ^2 22·846; P = 0·001). Similar results were reported by Demircivi *et al*,[6] whereas Kobayashi *et al*[1] claimed that TSAH is detectable as an important clinical pattern only in patients with low GCS.

The degree of TSAH was significantly related (χ^2 30·584; contingency coefficient: 0·414; P = 0·002) also to the outcome of patients (figure, A): 63·4% of grade 1 patients had a favourable outcome at six month follow up; however, it is interesting to note that grade 2 TSAH showed a non-homogeneous clinical evolution: 13 out of the 36 (36·1%) grade 2 patients in our series died, whereas eight presented severe disability at two month follow up examination and only five patients (13·9%) had recovered completely.

Four out of the six patients (66·7%) with TSAH grade 4 died; one patient presented with severe disability at follow up; and one



(A) Relation between degree of subarachnoid bleeding and GOS groups. TSAH classified by Fisher's criteria. χ^2 30·584; contingency coefficient = 0·414; P = 0·002. (B) Relation between GCS groups at admission and degree of subarachnoid bleeding as shown on CT. TSAH classified by Fisher's criteria. χ^2 22·846; contingency coefficient = 0·366; P = 0·001.

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patient was classified as GOS 4 two months after the injury.

Moreover, if Fisher grade and GOS groups were controlled for GCS groups in a multiple logistic regression, the relation remained highly significant ($F = 11{\cdot}614$, F required for 99·9% level of significance = 11·279), suggesting that Fisher grade has an important impact both on clinical severity and overall outcome.

On the other hand, the distribution and location of subarachnoid blood was not significantly related to clinical condition at admission (χ^2 8·706; contingency coefficient: 0·236; P = 0·069), whereas this pattern had a significant impact on the outcome (χ^2 16·736; contingency coefficient: 0·319; P = 0·033): a mixed distribution of subarachnoid blood carried a worst prognosis (52·4% mortality, 19% favourable outcome), if compared with cases of bleeding limited to basal cisterns (16·7% mortality, 52·8% favourable outcome) and over convexity spaces (20·9% mortality, 59·3% favourable outcome).

Uncomplicated TSAH on CT did not show a positive influence on neurological condition at admission and was not significantly related to the degree and distribution of subarachnoid blood. In our series uncomplicated TSAH itself did not represent a favourable prognostic factor: only 15 out of the 37 cases (40·5%) of uncomplicated TSAH had made a complete recovery at a six month follow up examination, whereas four (10·8%) patients were dead. These results contrast with those of Demircivi *et al*[6] who reported no mortality among patients with grade 1 TSAH and stated that all patients with uncomplicated TSAH rapidly recovered.

In conclusion, the results of the present study confirm that TSAH is a negative prognostic factor: the degree of TSAH is significantly related both to clinical condition at admission and outcome of patients, whereas the presence of subarachnoid blood both in basal cisterns and over the cerebral convexity indicates a significantly worse outcome.

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