Letter

Buruma et al reply.

In our article on blood-stained cerebrospinal fluid¹ we presented the results of tests of a number of methods used to distinguish intracranial haemorrhage from blood-staining due to traumatic puncture. Based on the results of this study we have proposed a simple scheme of tests for clinical practice.

We think that the Drs Aizenman and Tonks are a little mixed-up on this scheme. In essence this scheme comprises spectrophotometric scanning of the CSF, but CSF cytology may be added.

We propose scanning of the supernatant of blood-stained CSF at wavelength 415 with an ordinary spectrophotometer as we have routinely done for many years. An extinction below 0.023 implies that the blood-staining is due to a traumatic tap. Only if the extinction exceeds 0.023 is an absorption curve plotted by measuring the optical densities at wavelength 400-600 nm. This latter procedure essentially conforms to the one presented by Drs Aizenman and Tonks. If there is no characteristic bilirubin peak at 455 nm haemorrhage can be excluded. If bilirubin appears to be present this does not (contrary to the opinion of Drs Aizenman

and Tonks) prove the presence of haemorrhage. This can be learned from part C of the figure in our article. Apart from this finding it is a well-known fact that bilirubin in serum is firmly attached to albumin which implies that in patients with increased CSF albumin there is also bilirubin to be detected. This is also the case if serum bilirubin is elevated.

In case of a haemorrhage more than 3 hours prior to the lumbar puncture the oxyhaemoglobin resulting from erythrocyte breakdown is converted to bilirubin by the enzyme system of the CSF. If the CSF albumin content and the serum bilirubin content is normal, then the presence of bilirubin is due to haemorrhage. If the CSF albumin or the serum bilirubin is raised it is possible to detect a so-called bilirubin excess by way of the following formula:

$$\text{CSF bilirubin concentration} = \frac{\text{serum bilirubin concentration} \times \text{CSF albumin concentration}^{\dagger}}{\text{serum albumin concentration}}$$

We agree that usually these more complicated quantitative methods are not necessary, so we did not mention them in our article. We did stress the

usefulness of CSF cytology which by detection of erythrophages or siderophages or both in doubtful instances can prove the existence of haemorrhage.

Concluding, we would state that the scheme we proposed is even more simple than that of Drs Aizenman and Tonks since an absorption curve has to be plotted in only a limited number of cases.

The idea that bilirubin in the CSF is always the result of transformation from oxyhaemoglobin is incorrect. This may necessitate the use of CSF cytology or the use of the equation described above.

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References

- ¹ Buruma OJS, Janson HLF, Bergh van den FAJTM, Bots GTHAM. Blood-stained cerebrospinal fluid: traumatic puncture or haemorrhage? *J Neurol Neurosurg Psychiatry* 1981;44:144-7.
- ² Kortbeek LHThS, Booy AC. Bilirubin excess, erythrophages and siderophages in the differentiation of blood in cerebrospinal fluid. *Clin Neurol Neurosurg* 1979;81-4:255-79.