

Letter to the Editor — “Visual assessment for xanthochromia needs no revisitation”

Sir, recently Linn *et al.* compared visual with spectrophotometric assessment of xanthochromic cerebrospinal fluid (CSF) and concluded that a sample perceived as colourless is incompatible with the diagnosis of recent subarachnoid haemorrhage (SAH) [1]. Six CSF samples spiked with bilirubin and one normal CSF sample were assessed by 102 subjects visually. Spectrophotometry between 450–460 nm established extinctions from 0.01 to 0.09 in the six spiked samples.

The observations made by Linn *et al.* are valuable, albeit our interpretation of their results differs from their own. We think that the study confirms that visual assessment of the CSF for low concentrations of bilirubin is inferior to spectrophotometry. To illustrate this point we compare in Table 1 our own results contrasting visual with spectrophotometric detection of low concentrations of bilirubin with those of Linn *et al.* [1, 2]. For this post-hoc analysis, we have only included the observed frequencies of their samples seen as “yellow” or as “colourless”. Samples for which no decision could be made because the visual inspection was “doubtful” are not included. Clearly, both sets of data demonstrate that human colour vision is less sensitive than spectrophotometry for detecting small amounts of bilirubin from the CSF. It would be interesting to analyse the original absorption spectra of the Linn *et al.* [1] to determine whether their visual threshold (extinction of 0.06)

corresponds to ours (excitation purity or saturation of about 2.4%) [2].

We would like to pose three additional questions: (1) Why was an arbitrary cutoff of 0.05 chosen as opposed to 0.023 which was the criterion published by the same group previously [3]? (2) Why was a spectral bandwidth (450–460 nm) selected for measuring an extinction as opposed to the recommended absorbance at 476 nm [4]? (3) Given that the major “real life” problem for visual assessment of CSF from a recent SAH is likely to be contamination with blood (of red colour) [5], why was visual assessment restricted to a sensitivity problem (i.e., detection of low concentrations of bilirubin in an otherwise colourless sample)? If one extrapolates from previous data [3] such an analysis is more appropriate for CSF samples taken quite some time after a SAH, rather than, as the authors intended, recently following a SAH.

References

- [1] F.H. Linn, H.A. Voorbij, G.J. Rinkel, A. Algra, and J. van Gijn. Visual inspection versus spectrophotometry in detecting bilirubin in cerebrospinal fluid. *J Neurol Neurosurg Psychiatry*, 76:1452–1404, 2005.
- [2] A. Petzold, G. Keir, and T.L. Sharpe. Why human color vision cannot reliably detect cerebrospinal fluid xanthochromia. *Stroke*, 36:1295–1207, 2005.
- [3] M. Vermeulen, D. Hasan, B.G. Blijenberg, A. Hijdra, and J. van Gijn.

Xanthochromia after subarachnoid haemorrhage needs no revisitation. *J Neurol Neurosurg Psychiatry*, 52:826–808, 1989.

[4] UK NEQAS. National guidelines for analysis of cerebrospinal fluid for bilirubin in suspected subarachnoid haemorrhage. *Ann Clin Biochem*, 40:481–408, 2003.

[5] A Petzold, G Keir, and LT Sharpe. Spectrophotometry for xanthochromia. *N Engl J Med*, 351:1695–1696, 2004.

Axel Petzold MD PhD

Department of Neuroimmunology, ION
The Tavistock Intensive Care Unit, NHNN
Queen Square
London WC1N 3BG, United Kingdom
Tel.: +44 207837 3611 x4204
Fax: +44 207837 8553
E-mail: a.petzold@ion.ucl.ac.uk

Lindsay T. Sharpe PhD

Institute of Ophthalmology
11-43 Bath Street
London EC1V 9EL, United Kingdom

Table 1: Human colour vision is less sensitive than spectrophotometry for detecting small amounts of bilirubin from the CSF (data from references [2, 1]).

Excitation purity (%)	Petzold <i>et al.</i>			Linn <i>et al.</i>			χ^2	P
	Colour vision (observed frequency)	Spectrophotometry (observed frequency)	P	Extinction (at 450-460 nm)	Colour vision (observed frequency)	Spectrophotometry (observed frequency)		
36.6	1.00	1.00	...	—	—	—	—	—
18.2	1.00	1.00	...	—	—	—	—	—
9.3	1.00	1.00	...	0.09	1.00	1.00	...	NS ^a
4.8	0.90	1.00	...	0.07	1.00	1.00	...	NS
2.4	0.45	1.00	8.25	0.06	0.95	1.00	4.67	<0.05
1.66	0.00	1.00	22.0	0.04	0.72	1.00	31.7	<0.0001
1.04	0.00	1.00	22.0	0.02	0.09	1.00	157.9	<0.0001
0.62	0.00	1.00	22.0	0.01	0.12	1.00	148.1	<0.0001

^aThe statistics are based on the numbers from Table 1 in reference [1]: for an extinction of 0.09 none of the clinicians or medical students saw the sample as colourless (n=0), 50 clinicians and 49 students saw the sample as yellow (n=99), and 1 clinician and 2 students were undecided and therefore left out of this analysis. In contrast spectrophotometry clearly revealed the presence of bilirubin and all clinicians and students would have interpreted the spectrophotometric trace in the same way (n=102). The numbers for the other extinctions were analysed analogously.