

However, only 52.1% had normal gamma-glutamyltranspeptidase values, and when interview and laboratory data were combined 39.7% were judged to be drinking moderately. Obviously outcome data measured by interviews and/or questionnaires are far too optimistic.

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1. Keso L, Salaspuro M. Inpatient treatment of employed alcoholics: a randomised clinical trial on Hazelden-type and traditional treatment. *Alcohol Clin Exp Res* 1990; 14: 584-89.
2. Andersson S, Pamander M, Allebeck P. A trial that failed and the reasons why: comparing the Minnesota model with outpatient treatment and non-treatment for alcohol disorders. *Scand J Soc Med* 1990; 18: 221-24.
3. Keso L, Salaspuro M. Comparative value of self-report and blood tests in assessing outcome amongst alcoholics. *Br J Addict* 1990; 85: 209-15.

## Colour and visual discomfort in migraineurs

SIR,—People with migraine sometimes claim that their headaches are triggered by certain colours, usually red.<sup>1</sup>

15 patients with migraine (5 with aura and 10 without, according to predefined criteria<sup>2</sup>) and 15 controls matched for age and sex were asked to manipulate the colour of light falling on a passage of high-contrast text so as to make the text (a) most and (b) least comfortable. All subjects wore their most recent refractive correction. A simple apparatus allowed for the continuous, intuitive, and independent variation of the hue (colour) and saturation (colourfulness) of the light source with negligible change in luminance. The apparatus was based on that described by Wilkins et al<sup>3</sup> and had a range similar to that in their fig 3b. In each trial, the saturation was first constrained (Commission Internationale de L'éclairage 1976 saturation standard [CIE 1976  $S_{uv}$ ] = 0.9-1.5) while the subject varied the hue; then, the chosen hue was held roughly constant while the saturation was altered. The average luminance of the stimuli remained constant at 14 cd/m<sup>2</sup>. Although individuals varied widely in the colours chosen, the migraine group was significantly more likely than the controls to choose reddish colours as least comfortable (13 vs 6; 2 vs 9 for other colours)—a two-sample test of the concentration variable<sup>4</sup> showed that the angular variance of the CIE 1976 u'v' hue-angles selected by the migraineurs was significantly lower than that of controls ( $p < 0.001$ ). The groups did not differ when the most comfortable colours were considered (2 vs 5 for reddish, 13 vs 10 for other colours). Very similar results were obtained when the text stimulus was replaced by a pattern of high-contrast stripes.

Subjects had earlier found their favourite colour when viewing a blank white sheet of paper in the same apparatus. No consistent aesthetic preferences were noted in either group (Rayleigh tests showed that neither group departed significantly from a uniform distribution with respect to the hues chosen).

People with migraine have been reported to find strongly contrasting patterns aversive and potentially headache-provoking.<sup>5,6</sup> Our findings suggest that the visual discomfort produced in migraineurs by such patterns may be determined by the colour of light used for illumination. Visual dysfunction in migraine has been reported<sup>7</sup> but not, hitherto, with respect to colour perception. The dislike of red may relate to a disruption of transient system activity.<sup>8</sup>

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1. Debney LM. Migraine, a study of environmental and intra-personal factors (PhD thesis). Birmingham: University of Aston, 1973.
2. Headache Classification Committee of the International Headache Society. Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. *Cephalalgia* 1988; 8 (suppl 7).
3. Wilkins AJ, Nimmo-Smith MI, Jansons J. A colorimeter for the intuitive manipulation of hue, saturation and brightness. *Optical Physics* (in press).
4. Mardia KV. Statistics of directional data. London: Academic Press, 1972.
5. Wilkins AJ, Nimmo-Smith I, Tait A, et al. A neurological basis for visual discomfort. *Brain* 1984; 107: 989-1017.
6. Marcus DA, Soso MJ. Migraine and stripe-induced visual discomfort. *Arch Neurol* 1989; 46: 1129-32.
7. Khalil NM. Investigations of visual function in migraine using visual evoked potentials and visual psychophysical tests (PhD thesis). London: University of London, 1991.
8. Breitmeyer BG, Williams MG. Effects of luminance-background colour on metacontrast and stroboscopic motion: interactions between sustained (P) and transient (M) channels. *Vision Res* 1990; 30: 1069-75.

## Heart preservation solution containing polyethyleneglycol: an immunosuppressive effect?

SIR,—In a rabbit model 'Cardiosol', a heart preservation solution containing 5% polyethyleneglycol (PEG 20M, 'Carbowax'; Union Carbide Chemicals and Plastics), proved superior to standard cardioplegic solutions for short-term and 24 h heart storage.<sup>1</sup> After further testing in larger animals we did a preliminary clinical evaluation in cardiac transplantation. The aim was to establish the safety of the solution. Unexpectedly, the rate of acute rejection in recipients whose donor hearts had been preserved with cardiosol was low, hence this letter.

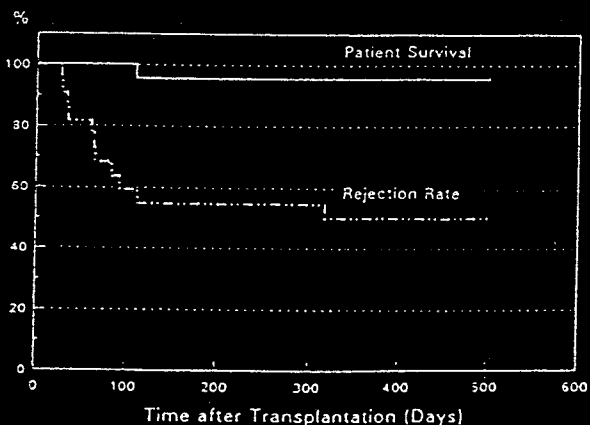
Between May, 1989, and April, 1990, 22 patients at the Pacific Medical Center received heart transplants preserved by an aortic flush with cardiosol. Standard practice before that had been to use a modified St Thomas solution:

Composition (mmol/l)				
	Modified		Modified	
Substance	Cardiosol	St Thomas	Substance	Cardiosol
Sodium	40	65	Phosphate	25
Potassium	125	11	Sulphate	5
Calcium	..	1	Lactobionate	100
Magnesium	5	3	Raffinose	30
Chloride	..	61	Glutathione	3
Bicarbonate	..	4.5	PEG 20M	50 g/l
Glucose	..	50 g/l		

The immunosuppressive regimen was unchanged: Minnesota antilymphocyte globulin 15 mg/kg was given for 14 days; cyclosporin was started on the day after surgery at a daily dose of 8 mg/kg by mouth in divided doses, followed by dosage adjustment according to blood level and toxicity; and prednisone 0.5 mg/kg daily was gradually reduced to maintenance levels. Any rejections, diagnosed by serial endomyocardial biopsy, were treated with oral prednisone 4 mg/kg per day for 5 days followed by gradual reduction to maintenance levels. A 10-14 day course of OKT3 was used to treat steroid-resistant rejection, and in very refractory cases this was sometimes followed by total lymphoid irradiation.

The 22 patients (21 males) were aged 32-70 (mean 51, SD 10) years. Cold storage time was 199 (40) min. All have been followed up for more than 16 months (mean 22 [4]). 1 of 2 recipients of a second heart transplant died. There were no deaths or graft failures in the 20 primary transplants. The cumulative (Kaplan-Meier) incidence of rejection was only 45% at 6 months and 50% at 1 year (figure). The age and sex distribution of these patients resembled those in the registry of the International Society for Heart Transplantation,<sup>2</sup> and the 1-year graft survival of 95.5% and 30-day hospital mortality of 0% for the cardiosol treated patients compare favourably with registry figures of 81% and 10%, respectively.

Although experimental methods have been reported for extending the duration of heart preservation, surgeons usually opt for safety by restricting preservation time to 4-5 h and using cardioplegic solutions designed for open-heart surgery. In our study preservation times averaged only 3 h so it is not surprising that



Actuarial patient survival and rejection-free survival for recipients of hearts preserved with cardiosol.