CORRESPONDENCE

Variability in measuring pH using litmus paper and the relevance in ocular chemical injury

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To the Editor

Emergency management of ocular chemical injuries require copious irrigation to dilute and remove the damaging agent. The quantity of irrigation is influenced by the initial ocular pH. Inaccurate pH measurements derived from litmus paper have been reported, and it has been our observation that litmus paper available is often aged and light exposed [1]. We wished to investigate inter-user variability in pH measurements using litmus paper.

A total of 22 participants (five ophthalmology trainees, 11 ophthalmic nurses, and six junior doctors) were recruited and asked to assess the pH of five different solutions. The tip of new litmus paper was submerged for 2 s, then correlated with the reference colour chart after 30 s.

Intra-class correlation coefficient was 0.753 (ANOVA), suggesting statistically similar values were obtained. However, pH readings differed by 1.69 pH units 5% of the time (95% CI 1.50–1.89) and measurements by two different individuals disagreed by more than 2.39 pH units 5% of the time (95% CI 2.11–2.67).

Tear film pH has diurnal variation, with more acidic measurements following prolonged eye closure. Tear pH can be alkaline in keratitis (7.14 ± 0.28), keratoconjunctivitis-sicca, and corneal transplantation, and acidic in contact lens wearers (6.66 ± 0.28) [2]. Litmus paper is cheap and readily available, but there are occasions when its accuracy is questionable. Light exposure can bleach the reference colour scale (Fig. 1a, b), and damp environments can influence the quality of the paper (Fig. 1c), while colour deficiency traits can influence an individual's ability to differentiate the scale [1, 3]. In 471 gastric fluid samples analysis found correlation

Fig. 1 Variation in the quality of pH paper and colour reference scale. **a** Normal pH reference scale. **b** Aged and light-exposed pH reference scale. **c** Variation in colour of litmus paper.

between litmus paper and a pH meter was moderate (0.59; $P < 0.001$) but the concordance was low (0.54) [4]. Studies of pH in 42 pleural fluid samples found significant variability with litmus paper compared with blood gas analyser (coefficient of variation 7.5%) [5].

Although there was a strong correlation of pH measurements in our study, 5% of the results were unreliable and could adversely influence clinical management. As blood gas analysers are available in most major casualty departments, we recommend their input to confirm abnormal pH measurements derived from litmus paper in ocular chemical injuries not responding to the initial management of irrigation.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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