

Novel use of trypan blue in ocular surface staining: redefining implications for this vital dye

Nova aplicação do azul de tripiano para superfície ocular: redefinindo corantes vitais

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ABSTRACT

Different applications of trypan blue (TB) for intraocular surgery have been reported, with very high levels of safety and efficacy. We describe the use of TB as an alternative vital dye for staining the ocular surface to assess the integrity of superficial cell layers of the cornea and the surface environment. This facilitates the diagnosis of various ocular surface disorders, including screening for dry eye disease (DED) among refractive and cataract patients. TB staining properties are different from fluorescein and both are stable in a solution, so that a double staining technique is introduced.

Keywords: Eye diseases/surgery; Ophthalmologic surgical procedures; Trypan blue/diagnostic use; Staining and labeling/methods; Case reports

RESUMO

Diferentes aplicações do azul de tripiano (AT) foram descritas para cirurgia intraocular, com elevados patamares de eficácia e segurança. Neste relato, é descrito a aplicação do AT como corante vital para superfície ocular, de modo a estudar a integridade das células da superfície corneana e conjuntival na superfície ocular. Tal abordagem permite um diagnóstico mais sensível de desordens da superfície ocular, destacando-se disfunção lacrimal ou síndrome do olho seco. O AT tem propriedades distintas da fluoresceína, com a qual se mantém estável em solução permitindo a técnica de coloração dupla que é introduzida.

Descritores: Oftalmopatias/cirurgia; Procedimentos cirúrgicos oftalmológicos; Azul tripiano/uso diagnóstico; Coloração e rotulagem/métodos; Relatos de casos

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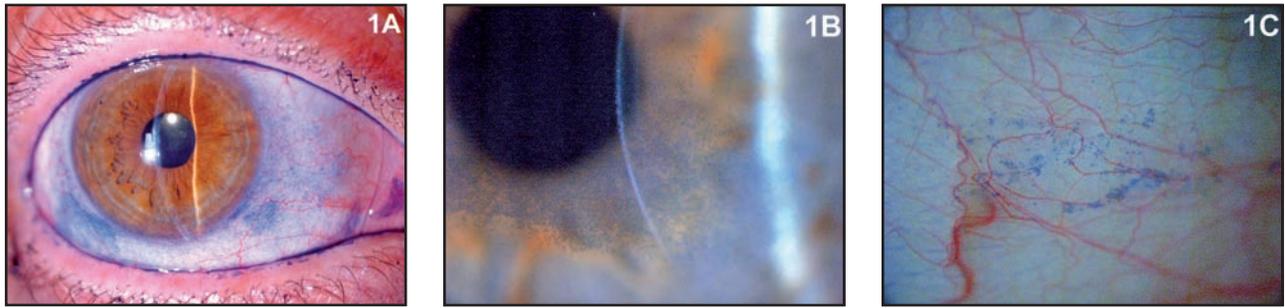


Figure 1A: Trypan blue staining of dry eye patient with Sjogrens Syndrome; 1B - Staining of LASIK induced neurotrophic epitheliopathy(LINE); 1C - Staining of conjunctiva in a patient with contact lens intolerance who suffered dry eye symptoms

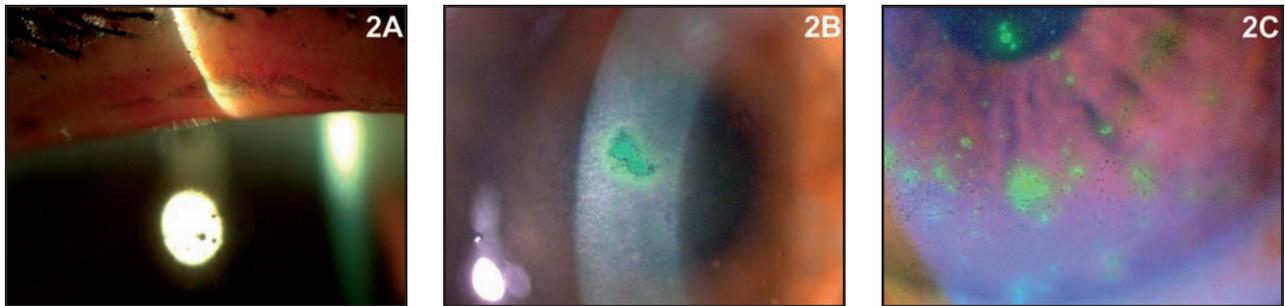


Figure 2A: Staining of the lid margin with trypan blue; 2B - Double staining of a recurrent corneal erosion with TB dye and fluorescein; 2C - Double staining in a patient with epidermic keratoconjunctivitis

INTRODUCTION

Ubiquitous in ophthalmology, vital dyes that stain living tissues including trypan blue, fluorescein, rose bengal, indocyanine green and lissamine green have all facilitated diagnostic and surgical techniques. Trypan blue (TB), an anionic hydrophilic azo dye, is in wide use particularly for staining the capsule during cataract surgery and aiding vitreoretinal surgery⁽¹⁾.

TB dye was first introduced in cataract surgery by Melles⁽²⁾, and was advocated for all cataract cases in Brazil by Dr. Carlos G. Figueiredo in 2000. Our group adopted this approach in cataract surgery, and it was incidentally noted that TB dye would stain conjunctival and corneal surfaces, particularly in those with poor ocular surfaces. Despite having several dyes that stain ocular surface tissues preferentially, a poor ocular surface can be a diagnostic challenge since symptoms are not always associated with clinical findings⁽³⁾.

A poor ocular surface is the leading cause of dissatisfaction after LASIK and cataract surgery⁽⁴⁾. We present a case series evaluating trypan blue's ability to stain the ocular surface.

METHODS

A cohort of seven patients with known ocular surface disorders were included in this case series. Informed consent was obtained, and the study was in accordance with the Declaration of Helsinki tenets. TB dye used was obtained from Ophthalmos pharmaceuticals (São Paulo, Brasil) at a concentration of 1%. Patients had the dye instilled in their conjunctival cul-de sac and were examined under the slit lamp using red-free or Amber UV cut free filters. Ocular surface staining was observed and photographed. A combination solution consisting of fluorescein and trypan blue 1% (50/50 mixture) was also obtained from ophthalmos and used in select patients.

RESULTS

Our series revealed no significant ocular irritation on exam and elicited no complaints with instillation of TB dye. In figure 1A, a patient with poor ocular surface and Sjogrens syndrome, TB dye demonstrated staining of the cornea and conjunctiva. TB dye also revealed fine staining of a poor ocular surface in a LASIK induced neurotrophic

epitheliopathy (line), figure 1B, and in a case of contact lens intolerance with dry eyes, figure 1C. TB dye was also able to stain the everted lids well, figure 2A, particularly the marginal conjunctival epithelium. We also applied a mixture of both trypan blue 1% and fluorescein in two patients. Figure 2B illustrates a recurrent corneal erosion in lattice dystrophy exhibiting well-defined staining of the edges with TB dye, and fluorescein staining of the bare stroma. This combination solution revealed two distinct staining patterns delineating superficial punctate keratitis very well in a patient with epidermic keratoconjunctivitis, figure 2C.

DISCUSSION

Vital dye staining of the ocular surface was first described in 1882 by Pflüger when sodium fluorescein allowed visualization of an epithelial defect⁽⁵⁾. Dyes have since played a critical role in ocular surface grading. Trypan blue has many applications including use in cataract surgery, endothelial keratoplasty, and vitreoretinal surgery. However, the study of TB dye for the ocular surface has been neglected since the original article by Norn in 1967⁽⁶⁾.

Trypan blue has many important applications in intraocular surgery and is very popular for facilitating capsulorrhexis^(2,7). Our research demonstrates that TB dye is also efficient at staining conjunctival and corneal surfaces in those with poor ocular surfaces. Of particular interest, is TB dye's complementary staining pattern in a double solution with fluorescein. This solution has broad implications in cataract and refractive surgery, dry eye management, diagnosing corneal herpetic disease, and aiding ocular surface surgery. Trypan blue presents an ideal and promising adjunct dye for the ocular surface given its wide availability, cost and

proven safety profile. Further studies evaluating the sensitivity of TB staining of the ocular surface as well as correlating its findings with severity of symptoms are required.

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