Autologous blood components applications in Ophthalmology

Essay
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Introduction

The word autologous is Greek in origin. The definition is exact 'autos' means self and 'logus' means relation. Thus, the meaning is 'related to self'. Autologous blood transfusion, designates the reinfusion of blood or blood components to the same individual from whom they were taken. (Sansom, 1993).

The treatment with autologous serum eye drops in an out-patient setting is possible, when the infrastructure for manufacture and delivery is provided in accordance with existing regulations. (Dietrich et al, 2008).

The use of autologous serum, in eye drop form, has been reported as a new treatment for several ocular surface diseases. These products have biomechanical and biochemical properties similar to normal tears. They contain components such as fibronectin, vitamin A and growth factors that have an epitheliotropic effect on the ocular surface epithelial cells. (López-García et al, 2007).

While pharmaceutical lubricants offer little to no nutrition eye drops made from autologous serum have a tear-like biochemical character and supply nutritional components. In vitro studies have shown that serum supports viability, proliferation and migration of ocular surface epithelial cells better than unpreserved pharmaceutical tear substitutes. Recently, the use of autologous serum in the form
of eye drops has been reported as a new treatment for severe ocular surface disorders. Serum eye drops may be produced as an unpreserved blood preparation. In vitro they are by nature non-allergenic and their biomechanical and biochemical properties are similar to normal tears. Cell culture experiments showed that corneal epithelial cell morphology and function are better maintained by serum than by pharmaceutical tear substitutes. (Geerling et al 2004).

Eye drops made from autologous serum are a new therapeutic approach for ocular surface disorders, such as persistent epithelial defects or severe dry eyes intractable to conventional therapy. Their use was first described by Fox et al in 1984 in their search for a tear substitute free of potentially harmful preservatives. Later Tsubota et al realised that because of the presence of growth factors and vitamins serum eye drops might also have a true epitheliotropic potential for the ocular surface.

With few exceptions pharmaceutical products are optimised for their biomechanical properties only. Fibronectin, vitamins, and growth factors have been used in vitro and in vivo to encourage epithelial wound healing. However, owing to stability concerns and limited clinical success, such single compound approaches failed to become incorporated into routine clinical management. Serum and other body fluids have been used as natural tear substitutes. They are applied as unpreserved, autologous products and thus lack antigenicity. Serum is the fluid component of full blood that remains after clotting. It contains a large variety of growth factors, vitamins, and immunoglobulins, some in higher concentrations than
in natural tears. These epitheliotropic factors are thought to be responsible for the therapeutic effect of serum observed on ocular surface disorders. The growth and migration promoting effects of serum on cell cultures in general and on corneal epithelial cells are well documented. Fox was the first to use serum to treat human dry eyes. However, the recent renaissance of this therapy began when Tsubota in 1999 described its successful use in eyes with persistent epithelial defects.

Tsubota was also the first to show that serum supports migration of an SV40 transfected human corneal epithelial cell line in a dose dependent manner and that immortalised, conjunctival epithelial cells as a sign of higher differentiation start to express mucin-1. (Geerling et al 2004).

In persistent corneal epithelium defects, autologous serum therapy can be considered as an effective and practicable therapy without adverse reactions. (Ferreira de Souza, 2001). Autologous serum eyedrops can be helpful in the treating various ocular conditions. Using eyedrops containing the 20-100% solution of patient's own serum, centrifuged 3000-4000 rpm, diluted in either saline, BSS or chloramphenicol solution, is a relatively new therapeutic strategy. Nevertheless, in some publications, a positive influence of using autologous serum topically has been proven in numerous ocular diseases. It has been found, that using autologous serum eyedrops is safe, such eyedrops can be stored in temperature ranging from -30 degrees C to +4 degrees C. Moreover, effectiveness of this treatment has been proven for many diseases, e.g.: keratoconjunctivitis sicca, superior limbal keratoconjunctivitis, recurrent erosion syndrome and persistent epithelial defects.
(Wilczyński, 2009). The use of 50% autologous serum eyedrops appears to be an efficacious medical treatment modality for persistent corneal epithelial defects that are recalcitrant to conventional medical therapy. (Jeng, Dupps, 2009). Treatment with autologous serum could be an efficient way to provide essential components to the ocular surface in the treatment of post-LASIK epithelial defects. Autologous serum induces faster epithelial healing than do artificial tears, leading to (1) a decrease in keratocyte apoptosis and migration of fibroblasts and myofibroblasts in the wound site, (2) a decrease in the migration of inflammatory cells, and (3) a consequent inhibition of cytokine release. This treatment could improve long-term refractive results post-LASIK (Esquenazi et al, 2005).

Potential disadvantages of serum eye drops are the limited stability and the risk of infection arising for patients and others handling serum. The marketing authorisation depends on the proof of efficacy in clinical trials, implementation of quality controls, reports of adverse effects, proof of expert knowledge, and other regulatory aspects. To minimise the variability of the product and to maximise the safety of its use, a written version of the standard production procedures should be established. Strict guidelines for good manufacturing, quality control and documentation must be established and maintained before and throughout the therapeutic use of autologous serum eye drops. The production of serum eye drops from autologous blood is time consuming and labour intensive the costs of this approach have to be considered. (Geerling, 2004).
Autologous platelet concentrates have been used by ophthalmologists to treat macular holes (Karger, Freiburg, 2009). Autologous platelet concentrate appears to be a safe and reliable adjunct to improve the anatomical outcome of conventional macular hole surgery (Kube, et al 2002).

Diabetic retinopathy remains a major cause of worldwide preventable blindness. The vitreo-retinal interface plays a critical role in the pathogenesis of diabetic retinopathy. The term pharmacologic vitreolysis refers to the use of enzymes to liquefy the vitreous gel, and to induce posterior vitreous detachment (PVD). Several human case series demonstrated that intravitreal injection of autologous plasmin enzyme was a safe and effective adjunct to vitreous surgery for the treatment of diabetic macular edema and proliferative diabetic retinopathy. Recently, it was shown that intravitreal injection of plasmin enzyme without the performance of vitrectomy induced complete PVD and reduced macular thickening due to refractory diabetic macular edema. (El-Asrar et al 2011). Intravitreal autologous plasmin enzyme may lead to an improvement of visual acuity and a reduction of macula edema in eyes with BRVO. (Sakuma, et al 2010). Autologous plasmin enzyme is useful in inducing a pharmacologic posterior vitreous detachment and in facilitating surgery (vitrectomy). (Azzolini, 2004).

Fibrin glue is a blood-derived product that is absorbable, relatively easy to use, and can be kept at room temperature or in a refrigerator. Although the use of fibrin as a biologic adhesive was first introduced in 1909, it was not until 1944 that Tidrick et al. used fibrin for skin graft fixation. Also it was in early forties that fibrin
glue was introduced to ophthalmology to fixate penetrating corneal grafts in rabbits. Numerous techniques have been used to prepare fibrin glue, either from homologous or autologous plasma. The autologous source avoids any possible risk of viral transmission. As the use of sutures is fraught with complications, bioadhesives have emerged as a viable alternative for tissue cooptation, over the last three decades. In summary, the advantages of fibrin glue that makes it so useful in ophthalmology are: 1-It reduces surgical time 2-Adequate bond strength, 3-good sealant, 4-safe, 5-minimal allergic or toxic reactions and 6-minimizes bleeding 8-Easy to undo 9-Disappears eventually 10-Can plug perforations 11-Excess amount can be trimmed 12-Does not produce inflammation. (Panda et al, 2009).

When compared to traditional suture closure, conjunctival closure with glue includes the following advantages: less postoperative patient discomfort, diminished postoperative inflammation (Guo, 2010). Fibrin glue can be used as an alternative to suturing for conjunctival closure following strabismus surgery. (Dadeya, MS, 2001). The use of fibrin adhesive in primary pterygium surgery with conjunctival autografts reduces the recurrence rate, surgical time, and postoperative pain when compared with sutures. (Ratnalingam V, et al 2010).
The aim

To highlight the efficiency, practicability and safety of various autologous blood components in ophthalmological practice including management ocular surface disorders, macular hole, diabetic macular edema, macular edema due to BRVO, and their use in sutureless conjunctival and corneal surgery.
The references


