Heighten Science PUBLICATIONS Corporation
ISSN
2577-140X

Opinion

Place of beta-radiation in the etiology and treatment of cataract

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Submitted: 05 February 2018
Approved: 08 February 2018
Published: 09 February 2018

Abstract

Among eye diseases, cataract is the most commonly encountered lens disease and the leading cause of reduced vision. Cataract caused by radiation develops due to neck & head, central nervous system tumors, eye localized tumors and total body irradiation. Today, the only treatment of cataract is surgery.

Beta radiation is seen to have an important place both in the etiology and treatment of cataract. Beta-radiation creates cataract in the lens as an adverse effect. However, beta radiation implementation is used for delay or prevention of cataract in glaucoma surgery. Effects of beta-radiation on the etiology and treatment should be supported by further prospective clinical studies.

Introduction

Among eye diseases, cataract is the most commonly encountered lens disease and the leading cause of reduced vision. It is the progressive transparency loss of the lens. Pathophysiology of cataract occurrence is yet to be enlightened, although oxidative stress has been described as an initiator factor. Although numerous causes are considered in the etiology, mechanisms occurring during development of cataract have not been fully elucidated. Today, the only treatment of cataract is surgery. However, a ten-year delay in the occurrence or development of cataract is estimated to decrease cataract surgery by half [1-3].

Cataract caused by radiation develops due to neck&head, central nervous system tumors, eye localized tumors and total body irradiation. The eye is an organ consisting of structures with sensitivity of varying degree. Lens is the most sensitive structure in the eye. It is a nonvascular structure without cell loss over the lifetime, which means there is no any mechanism for the removal of damaged cells. Radiation causes oxidative damage in the lens tissue, leading to formation of reactive oxygen molecules. These free radicals formed affect epithelial cells found in anterior region of the lens. These cells are damaged by the impact of irradiation and their mitotic activity decreases. As a result of these phenomena, abnormal lens fibers occur, causing occurrence of cataract. Minimum threshold dose required for the occurrence of cataract is 2 Gy in case of a single irradiation. If radiation is applied as fractions, this dose increases up to 8 Gy [2,3].

Glaucoma is in the first rank of avoidable causes of blindness. Glaucoma treatment aims to protect patients' visual function and quality of life. It is generally treated with medication. Trabeculectomy is a surgical procedure used to take intraocular pressure under control in glaucoma patients who do not respond to clinical treatment. Success of this form of surgery is restricted by scleral healing process, which may result in bubble failure and fibrosis of the surgical flap. Some studies have demonstrated that, these results could be improved using other resources such as beta radiation to prevent

How to cite this article: Cihan YB. Place of beta-radiation in the etiology and treatment of cataract. Int J Clin Exp Ophthalmol. 2018; 2: 006-007. https://doi.org/10.29328/journal.ijceo.1001012

fibroblasts. This method is usually utilized through a radioactive plaque at the surgery area, aiming to decrease the number of fibroblasts and thus, possibility of flap fibrosis. The application is rapid and simple, and includes controlling of both the dose and the area to be treated with accuracy. On the other hand, beta-radiation is especially attractive in the settings where regular drug supply and equipment maintenance are not available [3-5]. In a Cochrane review by Kirwan et al., investigating place of beta-radiation in glaucoma surgery including 4 randomized controlled study (RCT), people who had trabeculectomy with beta irradiation were found to have a lower risk of surgical failure compared to people who had trabeculectomy alone (pooled risk ratio (RR) 0.23 (95% CI 0.14 to 0.40). The authors reported that increased risk of cataract was decreased with beta-irradiation (RR 2.89, 95% CI 1.39 to 6.0). They concluded that trabeculectomy with beta irradiation has a lower risk of surgical failure compared to trabeculectomy alone [5]. In a study by De Fendi et al., patients undergone trabeculectomy either with or without beta radiation were compared. In that study, patients who received beta radiation were reported to not develop postoperative cataracts to any significant extent [6]. In a randomized controlled trial by Kirwan et al. in 2006, patients received beta radiation (10 Gy) were compared with those undergone 5FU trabeculectomy. In that study, beta radiation significantly reduced the risk of surgical failure after glaucoma surgery [7].

In conclusion, beta radiation is seen to have an important place both in the etiology and treatment of cataract. Beta-radiation creates cataract in the lens as an adverse effect. However, beta radiation implementation is used for delay or prevention of cataract in glaucoma surgery. Effects of beta-radiation on the etiology and treatment should be supported by further prospective clinical studies.

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