

Locations of Global Foreign Bodies and Their Impact on the Concerned Ocular Tissues

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Abstract: Ocular trauma is a large and complex subject. Though terminology has been defined yet there exist some discrepancies. Present paper deals with various types of Foreign Bodies (F.B.) lodged in and around the eye ball, their proper nomenclature and the pathological changes they are likely to produce in the adjacent tissues of the eye ball.

Keywords: Ocular, global, penetration, perforation.

INTRODUCTION

Eye ball or globe is a near spherical structure. The anterior segment mainly includes the cornea which is more curved than the posterior segment which consists of three coats viz. sclera, choroid and retina from without inwards. Kuhn et al¹ first described the terminology and classification of ocular trauma. He described two types of foreign bodies, intra-ocular and extra-ocular. There are many types of foreign bodies (F.B.) differing in shape, size, structure and velocity at impact and all these factors determine where they would ultimately settle in or around the eye ball. Earlier for a long time these F.B. were classified as intraocular or extraocular depending on whether they are in the cavity of the eyeball or outside it. However now the word ocular not only includes the eye ball but also the structures surrounding it like eyelids, orbit, lacrimal apparatus and conjunctiva collectively known as ocular adnexa. Hence it is preferred to use the word globe which indicates only the eye ball. Thus the terms now should be intra global and extra global. Shukla² has recently published a detailed classification of ocular foreign bodies.

METHODOLOGY

As mentioned earlier there could be various types of F.B. striking at different velocities at different places. However for the sake of understanding the principle we shall consider only a small spherical F.B. striking the eye ball at different velocities. They have been mainly classified as intra-global or extra-global depending whether they have been lodged on the surface of the eye ball or inside the eye ball. Their detailed situations are shown in (Fig.1) However, when the velocity of a F.B. is high, after piercing the eye ball once it may get lodged in the lens or on the coats of the eye ball on diametrically opposite side. This is termed as perforation with penetration (Fig. 2).

However in some cases when the velocity is very high it may pass through the diametrically opposite coat of the ball also making a hole of entry and a hole of exit. It is known as double perforation (Fig. 3) A new concept has shown that it could be neither of these but remain stuck within the coats of the eye ball (Park³, Shukla⁴). They have been called intra-corneal, intra-scleral or intra-mural). In the present paper location of mainly an intraocular foreign body has been explained logically in detail.

OBSERVATIONS

Type A Extraocular (Adhesion)	A - 1 : Extra-corneal
	A - 2 : Extra-scleral
	A - 3 : Extra-limbal
Type B Intraocular (Perforation)	B - 1 : Intra-atrial (A.C.)
	B -- 2 : Intra-vitreous
	B -- 3 : Intra-lenticular
Type C Intramural (Penetration)	C -- 1 : Intra-corneal
	C -- 2 : Intra-scleral
	C -- 3 : Intra-limbal
Type D Combinations (Perforation with Penetration)	D -- 1 : Corneal perforation + corneal penetration
	D - 2 : Corneal perforation + lenticular penetration
	D - 3 : Corneal perforation + sclera penetration
Type E Combinations (Double Perforation)	E - 1 : Corneal perforation + corneal penetration
	E - 2 : Corneal perforation + scleral perforation
	E - 3 : Scleral perforation + scleral perforation

Rarely there could be a triple perforation also in which all cornea, lens and sclera can get perforated.

In literature there has been some confusion about penetration and perforation. Penetration occurs in a solid structure whereas perforation always occurs in a cystic cavity of the body filled with air or fluid. After perforation the following five changes are very likely to occur. However they rarely occur in a small open globe injury. Hence open globe injury can not be considered same as perforation.

1. Through and through hole formation in the walls of the cavity
2. Escape of fluid or gas from the cavity
3. Decrease of pressure within the cavity
4. Change in the shape of the cavity (usually shortening)
5. Prolapse or incarceration of underlying tissue/tissues.

DISCUSSION

The subject of ocular foreign bodies is very vast and complex. It not only includes the F.B. of the eye ball but also of ocular adnexa which includes orbit, lids, lacrimal apparatus and conjunctiva. These F.B. are usually classified on the basis of their location as mentioned earlier (Shukla¹). However they can also be classified on the basis of the material they are composed of (such as iron, wooden, glass etc.), whether they are blunt or sharp, whether they are magnetic or non-magnetic, whether they are sterile or carry infection with them, whether they are single (commonly) or multiple and the velocity and angle at which they strike. Lastly it is also important to know how much was their pathway within the eye ball before finally settling down.

The present paper is mainly focusing on the changes these foreign bodies are likely to produce in the surrounding tissues on mechanical basis. They are usually the following :-

1. Adhesion : When a small F.B. strikes the globe on the cornea or conjunctiva. There is always some fluid over these structures so that the F.B. tends to stick to the place where it strikes the eye ball. Cornea and conjunctiva are the common sites. They produce pain, watering and redness more in the cornea. They are easily treatable.
2. Abrasion/Ulceration : When the F.B. is slightly bigger and strikes tangentially with greater force it will abrade the conjunctiva or cornea. It is more readily seen in cornea where it may cause an ulceration also which is slightly deeper. It is stained well with dyes and treatment is satisfactory in most cases. In both

these cases the depth is slight bur area involved is more.

3. Penetration : This may occur in the cornea or sclera as they are comparatively much thicker than conjunctiva. Here the surface area is usually small but the depth is more. However F.B. does not pass through and through either in cornea or sclera. Thus there is no communication between the exterior and the interior of the eye ball. This limits the infection from outside the eye ball to a great extent.
4. Perforation : Penetration and perforation are two common words not only in eye injuries but any type of injury in the body. Surprisingly till date there is a little confusion about these two conditions. In a paper on classification of ocular trauma Kuhn et al⁵ described both penetration and perforation as open globe injuries whereas the fact is that only perforation is an open globe injury and penetration is a closed globe injury. In perforation only there is a communication with the interior and exterior of the eye ball and not in penetration.

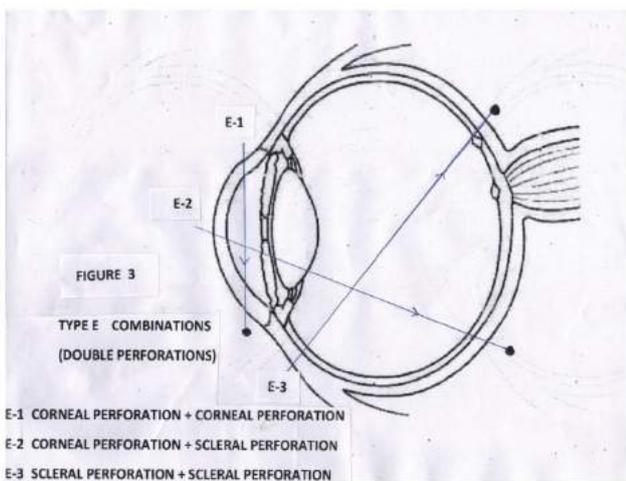
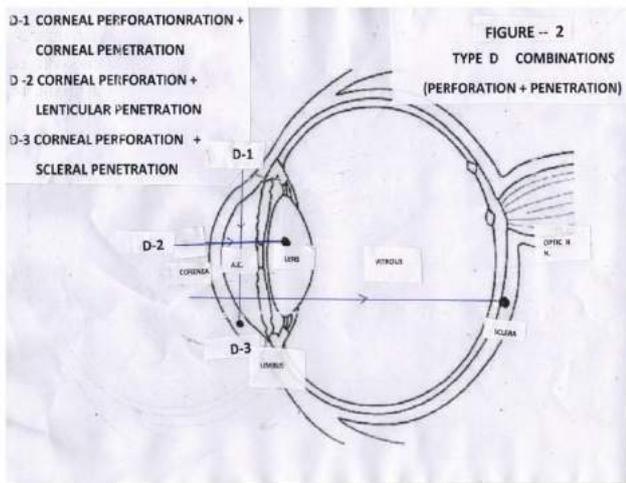
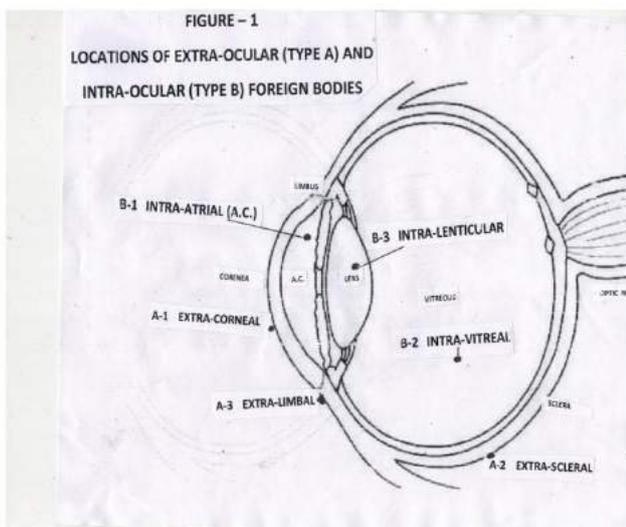
Most of the authors who wrote on ocular trauma classification just followed what was written by Kuhn et al¹ (Nassaralla J, Nassaralla B.A.⁶, Sarwat T, Mehta D.K.⁷ for obvious reason as it was endorsed by eight renowned organizations.

CONCLUSIONS

Foreign bodies are of many types and they can be classified in different ways. There correct localization is important in the diagnosis, management and prognosis in a given case. In a hollow cavity like eye ball it is all the more important to know whether a F.B. has perforated the eye ball or not. With perforation the prognosis becomes very grave. A standard classification of ocular trauma (Shukla, Agrawal et al)⁶ should be followed so that scientific work can be properly evaluated and compared with the work of others. In most cases earliest removal is the first line of treatment. However in some cases it is better to wait for some time till the initial inflammation settles down whereas in some cases removal of a F.B. may cause more harm and it may be better to leave the F.B.

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AUTHOR'S BIOGRAPHY



Dr. Bhartendu Shukla chose the practice of medicine for his career and obtained the M.B.B.S. degree from the Nagpur University in 1959 when he was 22 years of age. Fascinated as he was by the Science of Ophthalmology among the

different branches of medicine, Dr. Shukla pursued his studies for four years subsequently and earned the D.O. and M.S. degrees respectively from the Aligarh and Vikram Universities.

Dr. Shukla is a highly qualified medical man. He holds a doctorate degree awarded by the University of London for research in Ophthalmology, the first person in India to do so. His passion for acquisition of knowledge is manifest in the fact that he did not rest after this laurel earned in 1968 but strove to acquire the Membership of the National Academy of Medical Sciences and the Fellowships of the International College and the American College of Surgeons between the years 1984 and 1986. The most notable of the academic distinctions earned by him is the Doctor of Science degree of the Jiwaji University, Gwalior. He did it when he was sixty years of age and is again the first person in India to so qualify. With the advanced training he has had in the different aspects of his speciality, spanning reputable institutions in India and abroad,

Dr. Shukla's working life began with his entry into the service of the G.R. Medical College, Gwalior, in the year 1962. Starting as a Demonstrator, he rose on the strength of his devotion and dedication to the subject to be the Professor of Ophthalmology in the same institution twenty two years later. He served the college in that capacity until 1989 when he founded

the **Regional Institute of Ophthalmology** in Bhopal. As its Director, he steered the institution to progress for nine years and returned to Gwalior to head the **Institute of Health Management & Communication** in the State.

Dr. Shukla is associated with many professional bodies engaged in the advancement of Medical Science in and outside India. **The Indian Medical Association**, the **Ophthalmological Society of the U.K.**, the **Indian Intra-Ocular Implant Society**, the **Ocular Trauma Society of India**, the **Oculo-Plastics Association of India** and the **Strabismological Society of India** are a few of them. He was a member of the **National Society for the Prevention of Blindness** and was its Joint Secretary between the years 1983 and 1989. He served All India Ophthalmic Society as Joint Secretary during 1990-1993. He has been the Founder Secretary, the President and now the Patron of **Ocular Trauma Society of India**. He has been the first recipient of Air Marshal Boparai Award, Dr. Hari Mohan National Award and Life Time Achievement Award for his contribution to ocular trauma.

He has attended 35 International and about 50 National conferences on Ophthalmology.. He has presented papers at almost all of them and won great acclaim. He has himself conducted several workshops and seminars in **Gwalior** and Bhopal and delivered many lectures, which are known for the richness of their substance. He has also been an Examiner in Ophthalmology, external and internal, for several Universities and also for the **National Board of Examinations**.

The awards and honours that have come Dr. Shukla's way are many. Of these mention may be made of the A.P.W. Fellowship of the **Medical Research Council** in the U.K., the **Ciba Foundation Associateship of the Royal Society of Medicine**, the Sir John Wilson Trophy for work in the field of prevention of blindness and community ophthalmology, and our own Society's Dr. Dutta Oration Gold Medal for research in Glaucoma, the Visiting Scientist Fellowship and the Dr. P. Siva Reddy International Oration Award. In 2018 he was given International Hero Award of All India Ophthalmological Society.