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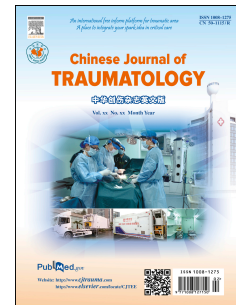
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## Mini-review

### New classification of ocular foreign bodies

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#### Abstract

Foreign bodies (FBs) in the eye are usually classified as intraocular (IOFB) or extraocular (EOFB). In IOFB the FB is within the eye ball and in EOFB it is outside. This classification seems oversimplified. Hence a new classification is proposed on the basis of FB locations, in which adnexal FBs (in orbit, lids, conjunctiva and lacrimal apparatus) are also included. These are further classified according to their exact location. FBs can also be classified in many other ways. Besides IOFB and EOFB, another condition IMFB (intramural foreign body) is also described. They are situated within cornea or sclera and are neither IOFB nor EOFB. Ocular trauma also includes trauma to ocular adnexa and hence the terms IOFB and EOFB have been replaced by IGFB (intraglobal foreign body) and EGFB (extraglobal foreign body).

#### Keywords:

Intraocular foreign bodies;

Extraocular foreign bodies;

Intraglobal foreign bodies;

Extraglobal foreign bodies;

Intramural foreign bodies;

Adnexal foreign bodies

## Introduction

Foreign bodies (FBs) are unwelcome anywhere in the body, more so in the ocular structures. They are traditionally described as intraocular (IOFB) or extraocular (EOFB) depending on whether they are within the eyeball or outside it.<sup>1-3</sup> Some authors<sup>4</sup> have used the word superficial “FB” in place of EOFB whereas others<sup>5-8</sup> have not even mentioned EOFB and have only mentioned retained IOFB. This may be because EOFB are easily treatable but they are very painful and may cause marked loss of vision. In the current Birmingham Eye Trauma Terminology (BETT),<sup>9</sup> cornea and sclera are taken as tissues of reference and together form the coat of eyeball. Full-thickness injury in them is called open globe injury and partial-thickness injury is called closed globe injury. Similarly a FB outside the corneoscleral coat is EOFB and within the coat is IOFB. However a FB may be within the coat also. Shukla<sup>10</sup> has termed it intramural (IMFB) in his classification of ocular trauma (Fig.1).

## New classification of ocular foreign bodies (OFBs)

In medical science it is often difficult to make watertight compartments in the classification of diseases. Here also a FB may involve more than one part of globe, e.g. cornea and sclera or cornea and lens. Similarly in ocular adnexa, a FB may involve lid and orbit or lid and lacrimal apparatus. Such FBs have been termed as mixed foreign bodies (MFB). There can be many combinations in this category. This type will also include FBs involving part of globe and part of adnexa. Thus three main types of OFBs are recognised, global, adnexal and mixed. Their further classification is given below.

### Global foreign bodies (GFB):

1. Intraglobal FB (IGF) - Depending on their exact location, they may be in the anterior chamber (IGA), iris (IGI), lens (IGL), vitreous (IGV), choroid (IGC) or retina (IGR);
2. Extraglobal FB (EFB) - They may be lying on the surface of cornea (EGC) or on the sclera (EGS);
3. Intramural FB (IMF) - Again they may be within the cornea (IMC) or within the sclera (IMS).

### Adnexal foreign bodies (AFB):

1. In lids or palpebrum (APF) - FB can be either on the surface of the lids (EPF) or within the substance of lids (IPF);
2. In the orbit (AOF) - FB can be either within the muscle cone (ICF) or outside in the peripheral space (ECF). Usually they are impacted in peripheral space (ECF);
3. In lacrimal passages (ALF) - FB could be in the lacrimal gland (ALG), in the lacrimal sac (ALS) or in the nasolacrimal canal (ALC);
4. In the conjunctiva (ACF) - FB may be in the palpebral conjunctiva (PCF), in the bulbar conjunctiva (PBC) or in the upper or lower fornix (FCF).

#### **Mixed foreign bodies (MFB):**

1. Mixed global-global (MGG) - These FBs involve more than one component of globe or eyeball. There could be any combination between cornea, anterior chamber, lens, vitreous, choroid or retina;
2. Mixed adnexal-adnexal (MAA) - There could be any combination with lids, orbit, lacrimal apparatus and conjunctiva;
3. Mixed global-adnexal (MGA) - There could be any combination of any global component with any adnexal component;
4. Mixed para-orbital (MPO) - A FB in orbit may extend to nasal cavity, cranial cavity or any of the paranasal sinuses.

The results have been summarised in Fig. 2 in form of a flow chart.

#### **Full form of abbreviation**

Full form of each abbreviation used in classification of FBs is listed in the following.

##### **A. GFB – global foreign bodies**

##### **IGF – intra global FB**

IGA – intra-atrial (implies in the anterior chamber)

IGL – intra-lenticular

IGV – intra-vitreous

IGC – intra-choroidal

IGR – intra-retinal

**EGF – extra global FB**

EGC – extra global corneal

EGS – extra global scleral

**IMF – intra mural FB**

IMC – intra mural corneal

IMS – intra mural scleral

**B. AFB – adnexal FB**

OFB – orbital FB: AIC – adnexal intraconal, AEC – adnexal extraconal

PFB – palpebral FB: AEP – adnexal extra palpebral, AIP – adnexal intra palpebral

LFB – lacrimal FB: ALG – adnexal-lacrimal gland, ALS – adnexal-lacrimal sac, ALC – adnexal-lacrimal canal

CFB – conjunct FB: APC – adnexal palpebral conj, ABC – adnexal bulbar conj, AFC – adnexal fornix conjunctival

**C. MFB – mix FB**

Global – Global

Adnexal – Adnexal

Adnexal – Global

Orbital – Paraorbital

**DISCUSSION**

From the above classification almost all types of ocular FBs are well described. It also takes into consideration the ocular FBs which involve more than one tissue of eyeball or ocular adnexa and provides a proper nomenclature for the same.

It may be mentioned that even this elaborate classification does not complete the spectrum of ocular FBs. Any subject can be classified in more than one way depending on the parameter used for classification. Thus keratoplasty could be lamellar or penetrating (depth), partial or total (width), optical or therapeutic (purpose), autologous or heterologous (donor).<sup>12</sup> Uveitis could be anterior or posterior (anatomical), granulomatous or non-granulomatous (pathological), acute or chronic (clinical), infectious or allergic (aetiological).<sup>13</sup> Similarly ocular FBs can be classified in different ways depending on the parameter used for classification. The classification which is more useful clinically is usually accepted as the

main classification. That is why we have described the classification based on location of the FBs.

FBs could be and have been described by other parameters also as it depends on the main purpose of research. Jianhe<sup>14</sup> while classifying mechanical FB described OSFB (ocular surface FB) and OWFB (ocular wall FB). OSFB is similar to EOFB. However OWFB has not been described. It appears to be similar to IMFB described by Shukla<sup>10</sup> earlier. Maneschg<sup>15</sup> reported that 58% of I.O.F.B. were due to hammering (other causes were not described). They also described that out of 31 cases, 27 were magnetic and only 4 were non-magnetic. In a study of intra-ocular and intra-orbital FBs, Napora et al<sup>16</sup> analyzed material, quantity, size, site of entrance and final IOFB location. In 62 patients IOFB was single in 93.5%; it was metallic in 85.5%; and intra-global in 83.9%. Unal<sup>17</sup> evaluated prognostic value of the ocular trauma score in cases of deadly weapon related open globe injuries with intraocular FBs.

## Conclusions

A system of classifying ocular FBs has been evolved based on their location. It is precise and comprehensive. Natarajan<sup>18</sup> has compared the classification of ocular trauma by Kuhn<sup>9</sup> and Shukla<sup>10</sup> and stated that Kuhn et al have not taken into consideration adnexal and chemical injuries. FBs can be classified in many ways but the one based on location is common and useful as it can greatly help in removal of FBs which is the main line of treatment.

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## REFERENCES

1. Duke-Elder S, MacFaul PA. *System of Ophthalmology. Part I*. 1<sup>st</sup> ed. London: Henry Kimpton; 1972:451-501.
2. Mukherjee PK. Extraocular foreign bodies. In: Shukla B, Natarajan S, eds. *Management of ocular trauma*. New Delhi: CBS Publishers; 2005:71-77.
3. Shukla D, Kim R. Intraocular foreign bodies. In: Shukla B, Natarajan S. eds. *Management of ocular trauma*. New Delhi: CBS Publishers; 2005:236-245.

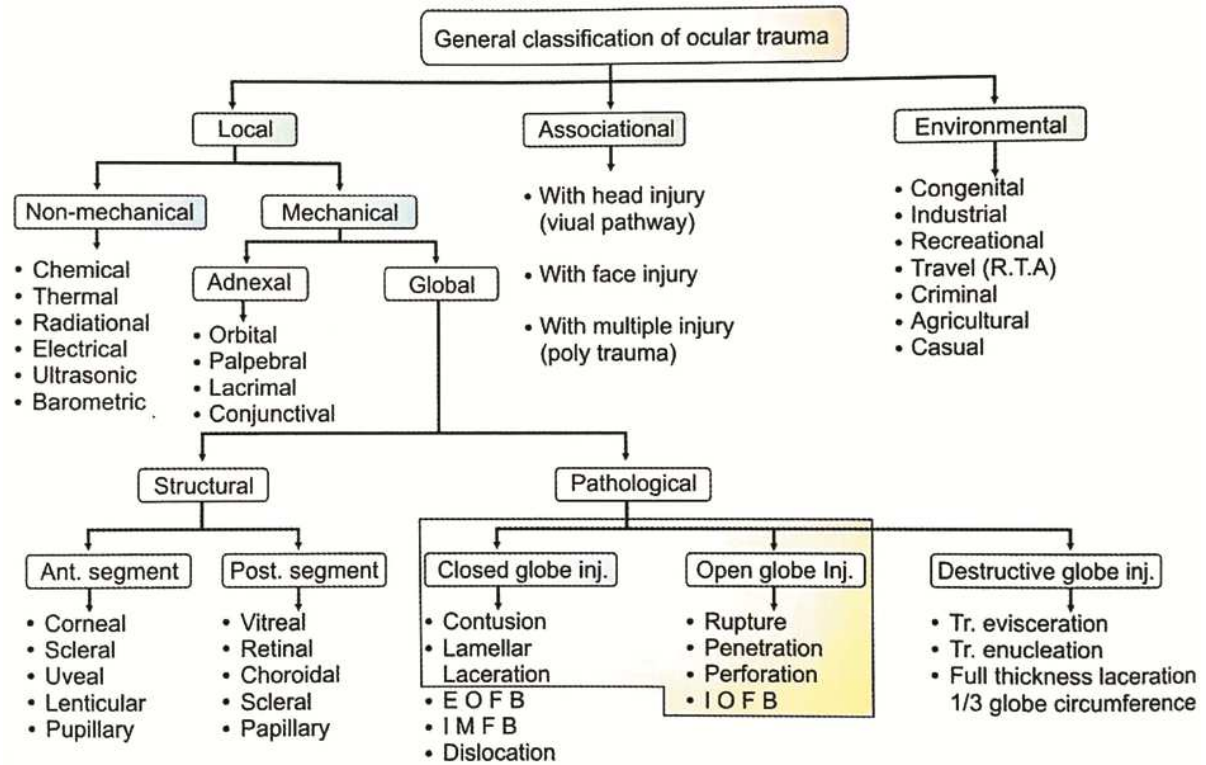
4. Kuhn F, Morris R, Mester V. Emergency management of ophthalmic injuries. In: Boyd S, Sternberg P. eds. *Modern management of ocular trauma*. New Delhi: J P Highlights; 2009:40-41.
5. Sanduja N, Aurora A, Luthra G. Retained IOFB. In: Garg A, Ruiz-Moreno JM, Shukla B, et al, eds. *Clinical diagnosis and management of ocular trauma*. St. Louis; Jaypee Brothers Medical Publishers (P) Ltd; 2009:155-159.
6. Kuhn F, Mester V, Morris R. Intraocular foreign bodies. In: Kuhn F, Pieramici DJ, eds. *Ocular trauma, principles & practice*. New York: Thieme; 2002:235-263.
7. Bustros SD. Posterior segment intraocular foreign bodies. In: Shingleton BJ, Hersh PS, Kenyon KR eds. *Eye Trauma*. Boston, Mosby Year Book; 1991:226-237.
8. Kim R, Tandon M. Retained intraocular foreign body. In: Mehta DK, ed. *Ocular trauma*. 1<sup>st</sup> ed. New Delhi: CBS Publishers; 2015:184-191.
9. Kuhn F, Morris R, Witherspoon CD. Birmingham Eye Trauma Terminology (BETT): terminology and classification of mechanical eye injuries. *Ophthalmol Clin N Am*. 2002;15:139-143.
10. Shukla B, Shukla D. New classification of ocular trauma. In: Garg A, Moreno JMR, Shukla B, et al eds. *Clinical diagnosis and management of ocular trauma*. New Delhi, Jaypee Brothers Medical Publishers; 2009:7-9.
11. Santos Tde S, Melo AR, Moraes HH, et al. Impacted foreign bodies in orbital region: review of nine cases. *J Arq Bras Oftalmol*. 2010;73:438-442.
12. Dhanda RP, Kalevar V. Corneal surgery. 1<sup>st</sup> ed. Indore: RK Publications; 1994:95-101.
13. Duke-Elder S, Perkins ES. *System of Ophthalmology*, Vol.9, 1<sup>st</sup> ed. London: Henry Kimpton; 1990:41-130.
14. Xiao JH, Zhang MN, Li SY, et al. A new classification for epidemiological study of mechanical eye injuries. *Chin J Traumatol*. 2014;17:35-37.
15. Maneschg OA, Resch M, Papp A, et al. Prognostic factors and visual outcome for open globe injuries with intraocular foreign bodies. *Klin Monbl Augenheilkd*. 2011;228(9):801-807.
16. Napora KJ, Obuchowska I, Sidorowicz A, et al. Intraocular and intraorbital foreign bodies characteristics in patients with penetrating ocular injury. *Klin Oczna*. 2009;111:307-312.

17. Unal MH, Aydin A, Sonmez M, et al. Validation of the ocular trauma for intraocular foreign bodies in deadly weapon-related open globe injuries. *Ophthalmic Surg Lasers Imaging*. 2008;39:121-24.
18. Natarajan S. Ocular trauma, an evolving subspecialty. *Indian J Ophthalmol*. 2014;61:539-540

Fig. 1. Classification of ocular trauma.<sup>10</sup>

Fig. 2. Classification of ocular foreign bodies.





# Classification of ocular foreign bodies (OFB)

