

## AETIOPATHOGENESIS OF POST-OPERATIVE ENDOPHTHALMITIS

Dr.(Mrs.) Gyanam G. Murthy  
 Prof. & HOD Ophthalmology  
 TNMC & BYL Nair Hospital, Mumbai - 400 008.

### Definition

Intraocular inflammation, predominantly in the vitreous cavity and/or anterior chamber, either infectious or non-infectious.

### Key features

- § Decreased vision
- § Hypopyon
- § Vitritis

### Associated features

- § Pain
- § Conjunctival hyperemia
- § Lid Oedema

**Introduction:** Endophthalmitis is an intraocular inflammation, predominantly in the vitreous cavity and/or anterior chamber. Intraocular and extraocular (microscopic ocular coat perforations) surgeries complicated by endophthalmitis present a potentially catastrophic event. The inflammation is usually infective in origin though remnants of cortical matter provoking endophthalmitis cannot be ruled out. Introduction of organisms usually occurs intra-operatively via flow of irrigating fluids and introduction of surgical instruments inside the eye. Despite improvements in asepsis and sterilization infectious endophthalmitis continues to persist as one of the most important sight threatening condition. Early diagnosis and appropriate treatment remain a clinical challenge with knowledge of its aetiopathogenesis serving as an invaluable tool for achieving optimum results.

### **Incidence of Postoperative Endophthalmitis in Relation to Type of Surgery:**

The incidence of Post-operative Endophthalmitis is dependent on the type of surgery, criteria used for diagnosis (clinical and laboratory culture) and the duration of follow-up. Intra Ocular surgeries complicated by endophthalmitis are cataract surgeries (ICCE, ECCE, phakoemulsification), Glaucoma filtration surgery and bleb related, pars plana vitrectomy, penetrating keratoplasty, pneumatic retinopexy, keratorefractive surgery, strabismus surgery, YAG Laser capsulotomy etc.

	Type of surgery	Percentage
1	Cataract	0.072
2	Secondary IOL implantation	0.30
3	Penetrating Keratoplasty	0.11
4	Filtering surgery for glaucoma	0.061
5	Pars plana Vitrectomy	0.051

The risk seems higher following penetrating keratoplasty because of the donor cornea being potentially contaminated and in secondary IOL implantation surgery due to lack of compartmentalization.

**Cataract Related Incidence** – As reported by Chrity and Lal in study of 77, 093 cases with 382 cases of endophthalmitis the incidence is 0.5%. In U.S. recent study of 23, 625 cases the incidence reported in ECCE is 0.072% and 0.093% in ICCE. Swaddi et al reported as 9.4% in 329 cases, which is a very high incidence. Majority of cases are caused by organisms colonizing conjunctival surface and periocular tissues like eyelid and nose.

**Bleb related Incidence** - Early onset- Incidence is 0.061% to 0.3%. Organisms are presumed to be introduced intraocularly at the time of surgery (spectrum similar to cataract related). Late onset - Incidence is 0.2% to 18%. Organisms are presumed to enter through the bleb. Organisms involved are streptococcus and H. influenzae. Higher incidence is seen in thin walled cystic blebs, full thickness procedures and adjunctive antimetabolite therapy<sup>4</sup>. In inferior trabeculectomy endophthalmitis can occur due to repeated mechanical abrasion with lower eyelid blinking and chronic exposure to bacteria residing in tear pool and eyelid margin.

**Incidence in other Surgery** In penetrating keratoplasty higher incidence of culture positive corneo scleral rims are more common. In R.D surgery close diathermy application produces a necrotic sclera with subsequent infection. Dismal prognosis is seen in paediatric intraocular surgery. Following YAG capsulotomy organisms possibly sequestered in the capsular bag during surgery are released into the vitreous cavity after laser capsulotomys. Perforation of corneal ulcer secondary to extended contact lens use as a correction of

aphakia, leads to an open eye and chances of infection increases.

**Microbiologic spectrum in postoperative endophthalmitis** Although all groups of bacteria can produce postoperative endophthalmitis 56 to 90% cases are caused by gram positive bacteria. 6 to 40% caused by gram negative bacteria, and 3 to 13% cases are accounted fungal endophthalmitis. Of gram positive bacteria 30 to 74% are coagulase negative (*S. epidermidis*), 10 to 30% are streptococci and 6 to 30% are *S. aureus*. Of gram negative bacteria 30 to 40% are *Proteus*, 20% *Pseudomonas aeruginosa* and 20% *Hemophilus*.

Bacterial Endophthalmitis	
Gram Positive Bacteria	Incidence
Staph. Epidermidis	30% to 70%
Streptococcus pneumoniae, viridans, pyogenes	10% to 30%
Staph. Aureus	6% to 30%
Total	56% to 90%

Bacterial Endophthalmitis	
Gram Negative Bacteria	Incidence
<i>Proteus mirabilis</i>	30% to 40%
<i>Ps. aeruginosa</i>	20%
<i>Haemophilus influenzae</i>	20%
<i>Klebsiella pneumoniae</i>	10%
<i>Escherichia coli</i>	7%
Enterococci	6%
Total	6 to 40%

Fungal Endophthalmitis	
Fungii	Incidence
<i>Candida Albicans</i> <i>Aspergillus</i> <i>Coccidioides</i> <i>Cephalosporium</i> <i>Paecilomyces</i>	Total 3-13%

In the Endophthalmitis Vitrectomy Study (EVS), gram-negative isolates on culture were obtained in only 6% of endophthalmitis cases following cataract surgery. The gram-negative organisms are highly virulent, produced endotoxins and rapidly colonize in the vitreous cavity, hence early Vitrectomy becomes necessary in these cases.

*Chronic/Delayed onset endophthalmitis*

Organisms involved are propionibacterium acini, propionibacterium granulosum, achromobacter, corynebacterium and fungi. There is a formation of white

plaque within equator of remaining lens capsule or posterior surface of IOL (cocooning).

Delayed onset Endophthalmitis
<b>Causative organisms</b>
¶ Propionibacterium acini
¶ Propionibacterium granulosum
¶ Actinomyces
¶ Achromobacter
¶ Corynebacterium
¶ Fungi

**Risk Factors associated with postoperative endophthalmitis** The risk factors can be divided into patient factors and surgical factors or into preoperative, intraoperative and postoperative factors.

**1. Patient factors -**

*Ocular conditions*

- Bacterial blepharitis/Conjunctivitis
- Nasolacrimal duct obstruction/infection
- Ocular prosthesis

**Systemic conditions**

- Active infection (upper respiratory tract, skin, soft tissue)
  - Diabetes
  - Immune suppression
- 2. Surgical Factors**
- IOL's with polypropylene haptics<sup>8</sup>
  - Prolonged surgery
  - Vitreous loss
  - Wound abnormalities (vitreous wick, wound leak, inadvertent bleb, suture abscess, and wound dehiscence)
  - Use of silk suture for wound closure
  - Contaminated irrigation solution<sup>3,7</sup>
  - OT personnel and environment as source of infection.

**1. Preoperative Factors**

- Bacterial blepharitis
- Acute conjunctivitis
- Lacrimal drainage obstruction/infection
- Contaminated eye drops

**2. Intraoperative Factors**

- Vitreous loss
- Prolonged surgery
- Contaminated irrigation solutions
- Contaminated surgical instruments

**3. Postoperative Factors**

- Wound dehiscence
- Bleb-related
- Contaminated eye drops

- Unhygienic environment
- Trauma to operated eye

**Sterile Post Operative Endophthalmitis** Use of refrigerated BSS and subconjunctival antibiotic in sutureless wound closure permits intraocular entry of toxic antibiotics due to poor coaptation of wound resulting in a sterile post-operative endophthalmitis.

**Relation with prophylactic antibiotics** *Driebe et al*<sup>2</sup> found out of 62 culture positive cases of endophthalmitis, 44 had been given sub conjunctival antibiotics. 90% cases were given antibiotic to which the organism was susceptible. Single application of 5% povidone iodine solution has a bactericidal effect, equivalent to a 3-day course of topical antibiotics.

### Pathogenesis and mechanism of tissue damage

1. Organisms contact host or enter host cells with subsequent cell death.
2. Organisms release endotoxins and/or exotoxins, enzymes that degrade tissue components and damage blood vessels and cause ischaemic necrosis.
3. Induction of host cellular immune response that although directed against the invader may cause additional tissue damage including suppuration, scarring and hypersensitivity reactions.

Thus defense response of the host are a two edged sword, being necessary to overcome the infection but at the same time contributing to tissue damage. This is responsible for vitreous fibrosis and immune mediated damage to retina besides direct invasion by organisms.

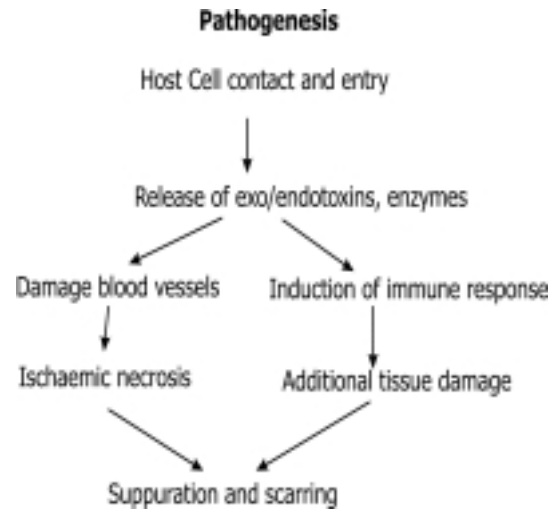
Acute endophthalmitis has features of a **suppurative inflammation**. Tissue damage increases vascular permeability and polymorphonuclear infiltration with neutrophils being attracted to site of infection by release of chemoattractants (include secreted bacterial peptides, which contain N-formylmethionine residues at their aminoterminal that are recognized by specific receptors on neutrophils).

Alternatively endotoxin release stimulates macrophages to release interleukin-1 or Tumor necrotic factor which results in pus formation depended on location and organism involved. There is a progressive involvement of anterior segment structures (cornea, aqueous, anterior uvea) and further spread to involve all coats of the eye resulting in Pan ophthalmitis. Subsequent to ciliary body detachment the end result is Phthisis bulbi.

In Chronic course the presentation is more indolent with cytokine mediated stimulation of fibroblasts, procollagen and eventual fibrosis.

### Highlights of postoperative endophthalmitis

- Several studies have shown that most cases



of endophthalmitis are caused by organisms that normally inhabit conjunctival sac either as saprophytes or opportunistic pathogens.

- Staphylococcus epidermidis has been isolated from the conjunctival sac in 69% and staphylococcus aureus in 33% of normal eyes. H.influenzae and rarely fungi may also be present as normal micro-flora.
- Majority of postoperative endophthalmitis studies have indicated the causative organism as derived from the patients' own periorbital microbial flora.
- Recent studies have shown a close resemblance between isolates obtained from conjunctival sac and intraocular aspirats (genetically indistinguishable).
- Utmost topical asepsis and sterility during all intraocular procedures are absolutely mandatory to prevent postoperative endophthalmitis.

### References

1. Kattan HM, Flynn HW, Pflugfelder et al Nosocomial endophthalmitis survey. Current incidence of infection after intraocular surgery Ophthalmology 1991; 98: 227-38
2. Driebe WT Jr, Mandelbaum S, Forster RK et al Pseudophakic endophthalmitis. Diagnosis and Management Ophthalmology 1986; 93: 442-8
3. Mandelbaum S, Forster RK, Glender H et al. Late onset endophthalmitis associated with filtering blebs. Ophthalmology 1985; 92: 964-72
4. Wolmr B, Liebmann J M , Sassani JW, et al. Late bleb related-endophthalmitis after trabeculectomy with adjunctive 5-Fluorouracil Ophthalmology 1991; 98: 1053-60.
5. HO PC Mc Mecl W. Bacterial endophthalmitis after retinal surgery Retina 1983, 3: 99-102
6. Leveille AS, Mc Mullan FD, Cavanagh HD endophthalmitis following penetrating keratoplasty

Ophthalmology 1983; 90: 38-39

7. Allen HF, Mangiaracine AB: Bacterial endophthalmitis after cataract extraction II. Incidence in 36, 000 consecutive operations with special reference to preoperative topical antibiotics.

Arch Ophthalmol 91: 3-7, 1974.

8. Sherwood DR, Rich WF, Jacob JS et al: Bacterial contamination of intraocular and extraocular fluids during extracapsular cataract extraction. Eye 3: 308-312, 1989.

**HOW MUCH DOES YOUR BIMANUAL IRRIGATION-ASPIRATION SET COST?**

Dr Anjaneya P Agashe

In a casual market survey, it was found that Bi-manual I/A set costs nothing less than Rs.1500/- (range from Rs.1800/- to more than Rs.10,000/-)

This titanic couple resting on a sponge bed in a sleek plastic case looked very attractive and ownworthy but my pocket did not allow me. So I contacted a local instrument manufacturer and I got made to order the following:

1. A 20 G curved canula with blind, rounded & smooth tip and two large irrigation openings on the sides (1 to 1.5 mm behind the tip) :

when mounted on the IV line with irrigation handle, Ringers Lactate solution should be free flowing.

2. A 22 G curved canula with blind, rounded & smooth tip and a single aspiration opening 1 to 1.5 mm behind the tip for aspiration
3. A double-ended (i.e. canula/ needle can fit on both ends) irrigation handle (to be used as aspiration handle)
4. A regular irrigation handle

*And my bimanual I/A set was ready in just Rs.400/- .....Simple. Easy to assemble-dismantle & Clean*

**SUNWAYS SPECIALITIES FOR OPHTHALMIC CARE**

<b>I O L P R O D U C T S</b>	<b>A N T I B I O T I C S T E R O I D S</b>	<b>M Y D R I A T I C S C Y C L O P L E G I C S</b>
Inj Hyprosol PFS	Nebracin Eye Drops	Tropicacyl Plus
In Carpinol	Nebracin DM eye drops	Tropicacyl 1%
Inj Epitrate	Gentamide Eye drops	Sunephrine H
Inj Oculan	Gentamide DM Eye drops	Sunephrine 10%
Paracain	Ultiflox Eye Drops	Mydryn
Septidine	Chlorosun Eye Drops	A trosun

<b>N e w I n t r o d u c t i o n</b>	<b>G e n e r a l C a r e</b>
Algic Eye Drops	Biocula Eye Drops
Loflox Eye Drops	Phenil Eye Drops
Prednisolone Acetate Suspension	Vasozine Drops
Lubrilac Ointment	Lacrigel Ointment

**SUNWAYS (INDIA) PVT. LTD.** Jai Prakash Road No 2, Goregaon (East), Mumbai 400063

Tel: 873 3172, 873 2813

Fax: 91(22)873 0778