

# Diagnosis and Management of Endophthalmitis

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Infectious endophthalmitis presents one of the most catastrophic complications of intraocular surgery and penetrating injuries of the eye. The purpose of this communication is to consider the steps necessary to make an initial definitive diagnosis and to consider an approach to management using newly considered routes of antibiotic delivery.

Endophthalmitis should be considered whenever the inflammatory reaction seems greater than one would expect considering the extent of surgery or degree of trauma.

We have arbitrarily divided endophthalmitis into four groups:

1. Recent post-operative
2. Delayed post-operative, which usually includes glaucoma blebs or inadvertant post-cataract blebs.
3. Traumatic endophthalmitis
4. Metastatic, endogenous endophthalmitis

## DIAGNOSIS

Bacterial post-operative endophthalmitis usually presents in two to three days following surgery, with variable pain, but classically corneal edema, clouding of the anterior chamber, hypopyon and early vitritis. Any of these signs out of proportion to what one would expect after considering the degree of difficulty of the surgery or extent of the trauma should alert one to suspect an infectious process. Waiting for severe pain, lip edema, or dramatic visual deficit, also results in delay in treatment with probable subsequent compromise of the eye. Recently we have seen cases of delayed onset infection due to *Staphylococcus epidermidis* presenting two to three weeks and as late as ten weeks following surgery. However, a delayed inflammatory process of more than two weeks should alert one to the possible infection by fungi. Such infections usually follow a latent period, the inflammatory process is much less severe, and it appears as a progressing iridocyclitis often with fungal elements seen near the edge of the pupil or in the anterior vitreous. Treatment with antibiotics and steroids often masks the initial inflammatory reaction. Both fungal and bacterial endophthalmitis must be differentiated from factors contributing to a sterile inflammatory res-

ponse such as retained lens material, post-operative iridocyclitis, occasional chemical reaction, and commonly anterior chamber or vitreous hemorrhage. However, if the question of possible infection is raised and one suspects that he may be dealing with an infectious endophthalmitis, then specific diagnostic maneuvers are mandatory prior to initiating specific therapy.

Patients suspected of harboring infectious endophthalmitis are taken to the operating room, after appropriate sedation and retrobulbar anesthesia, the anterior chamber and vitreous fluid is aspirated for culture and stained smears. Aspiration of the anterior chamber is accomplished by making a keratotomy through the peripheral clear cornea with a razor blade, incising the cornea deeply, and then entering the anterior chamber with a 25 or 27 gage needle attached to a 1 mm tuberculin syringe. Care should be exercised to avoid touching the corneal endothelium and particularly the lens in phakic patients. Usually .1 to .2 ml of fluid is obtained and immediately inoculated into media described below. In aphakic patients, a second tuberculin syringe fitted with a 22 gage needle is passed through a slightly enlarged keratotomy incision into the vitreous where it is manipulated until .2 to .3 ml of vitreous aspirate is obtained. In phakic or aphakic patients suspected of endophthalmitis complicating either filtering blebs, trauma, or on a metastatic basis, the vitreous may be aspirated through a sclerotomy at the pars plana 4.5 ml posterior to the limbus with or without accompanying anterior chamber paracentesis. If an adequate vitreous sample is not obtained by this method or if one suspects a fungal etiology, the keratotomy or pars plana incision is enlarged to accompany a vitreous instrument such as the vitreous infusion suction cutter (VISC) and introduced to remove formed vitreous. This sample, diluted by irrigating fluid is then passed through a disposable membrane filter. The filter can then be sterily removed, cut into pieces and inoculated onto appropriate media. (1)

The inoculum aspirated from the anterior chamber and vitreous, or sections of the membrane filter through which the vitreous sample is passed, are placed onto blood agar, brain heart infusion, chocolate agar, and thioglycolate liquid to be maintained at

body temperature (37°C) and onto Sabouraud agar, blood agar, and brain heart infusion with gentamicin to be maintained at room temperature (25°C) for fungal isolation. Care is exercised to place the drops of aspirate away from the edges of the plate; the mouths of the tubes of liquid media are flamed before and after inoculation. Slides are prepared for Gram and Giemsa staining and more recently for the modified Grocott's methenamine silver stain (GMS). If there is limited availability of culture media, then either rabbit blood agar or chocolate agar maintained at 37 degrees, preferably at increased CO<sub>2</sub> tension, is adequate, but certainly not as inclusive as the above media.

In order to properly interpret the culture growth, criteria have been established, which include for a positive isolate: growth of the same organism on two or more media or semiconfluent growth on one or more solid media. Growth in one liquid medium only or scant growth on a solid medium, particularly if separate from the site of inoculation, should be considered equivocal or a contaminant. Growth of bacteria is usually evident by 24 hours and growth of fungi by 48 hours.

In our recent experience, when endophthalmitis is suspected, 50% of such cases have a positive culture by the above criteria. Of those, 50% are positive by smear and 50% represent Gram positive organisms.

## MANAGEMENT

Patients with suspect endophthalmitis should be hospitalized. If the inflammatory reaction is consistent with the expected post-operative course and does not raise an index of suspicion of infection, the patient may be hospitalized for observation or managed on an out-patient basis.

Infectious endophthalmitis poses a major challenge to the ophthalmologist because of the consistently poor results obtained by conventional therapy (i.e. topical, subconjunctival and systemic treatment). Despite the development of more potent antibiotics, the salvage rate is low, in part due to poor penetration of antibiotics into the anterior chamber and particularly into the vitreous which is the primary site of established infection. Interest in developing alternative and more effective routes of delivery and methods of treatment using intraocular antibiotics has gained increasing clinical application. Comparative concentration of antibiotics obtained in the vitreous by direct injection far exceed the minimal bacteriocidal levels or inhibitory levels that can be achieved by systemic, periocular, or topical

routes. The relative safety of numerous antibiotics has been established in animal models and in the human.

A consideration of combining intraocular antibiotics with therapeutic vitrectomy has recently been evaluated and although still experimental this approach may offer a significant breakthrough in the management of infectious endophthalmitis.

On the basis of the above background information and experimental studies, the current therapeutic regime used at the Bascom Palmer Eye Institute in Miami is to treat suspect endophthalmitis by the following protocol:

1. Diagnostic anterior chamber and vitreous aspiration (or vitrectomy)
2. Initial therapy:
  - a. Intraocular: gentamicin (Garamycin) 0.1 mg and cephaloridine (Loridine) 0.25 mg
  - b. Subconjunctival: gentamicin 40 mg and cephaloridine 100 mg or methicillin (Staphicillin) 100 mg; triamcinolone (Aristocort) 40 mg
  - c. Topical: gentamicin 9 mg/ml and bacitracin 5,000 units/ml or cephaloridine 50 mg/ml
  - d. Systemic: cefazolin (Kefzol) 4 to 6 gms/day
3. If cultures are positive for virulent bacteria, consider repeating the above intraocular injections at the bedside on the second and fourth post-operative days. Continue topical treatment hourly, subconjunctival treatment daily, and systemic therapy. Consider therapeutic vitrectomy with repeat intraocular antibiotics.
4. If cultures are negative after 48 hours, do not repeat intraocular antibiotics. Consider tapering or discontinuing topical, subconjunctival and systemic antibiotic therapy while continuing topical and subconjunctival corticosteroids.
5. If a fungal etiology is anticipated, as evidenced by time of onset and clinical appearance, vitrectomy for both diagnostic and therapeutic purposes is performed initially with intraocular injection of both gentamicin and amphotericin B, 0.005 to 0.01 mgs.

The above approach to management, therapy - topical, subconjunctival, and systemic routes, but the alternative of intraocular antibiotics and consideration of therapeutic vitrectomy. Since present conventional therapy for endophthalmitis is often inadequate, it is necessary to consider the

possible advantages of alternative therapy. (2)

## PREVENTION

Successful management of culture proved infectious endophthalmitis results in compromised visual function at best and therefore indicates the need for prevention of this catastrophic complication. The apparent decreased incidence of postoperative endophthalmitis over the past several decades indicates that significant strides have been made; success has been attributed to improved sterile and operative techniques, to prophylactic use of antibiotics, and particularly to an awareness of those factors which contribute to postoperative infection.

A careful pre-surgical examination is probably the most important prophylactic step in the prevention of endophthalmitis. Although it is interesting to speculate about the importance of preoperative cultures, their routine use is probably not practical nor beneficial and certainly does not repla-

ce a careful preoperative examination. Preoperatively, patients with blepharitis, conjunctivitis, significant dermatologic disease, or lacrimal obstruction, should have surgery deferred, cultures obtained from the conjunctiva and lids, and appropriate preparation of the eye by treatment of the inflammatory response prior to surgery. The other situation in which preoperative cultures may be of some help is in one-eyed patients, particularly if a prosthesis is in place in the second eye, where there is probably a higher incidence of Gram negative organisms harbored in the conjunctiva. In these cases, a culture should be taken and both eyes treated with topical antibiotics. Surgical lacrimal correction should also be made in patients prior to elective intraocular surgery if nasolacrimal obstruction is present.

## REFERENCES

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