Chronic Pseudophakic Endophthalmitis After Uneventful Phakoemulsification: A Case Series and Review of Litterature

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Abstract

Purpose: To report a retrospective case series of patients with chronic post operative endophthalmitis (CPE) after uneventful phacoemulsification (PKE) with intraocular lens (IOL) implantation.

Methods: this study was conducted between January 2011 and June 2020, including patients with delayed-onset endopthalmitis occurring at least 2 weeks after uneventful PKE+IOL. Diagnosis was based on typical clinical features associated or not to proven sample culture. Treatment was based on step-by-step management, depending on results of microbiology and response of treatment. It consisted in first line medical treatment with a two-approach intraocular and systemic antiobiotics, followed, if necessary, by a second line conservative-IOL surgical treatment with pars plana vitrectomy (PPV), and a third line non-conservative-IOL surgical treatment with re-PPV associated to IOL explantation.

Results: Seven patients were included with a mean age of 62,5 years. Mean duration interval between cataract surgery and diagnosis of CPE was 31,3 weeks. All patients presented a decrease of visual acuity with white intracapsular plaques. Only one patient had positive IOL culture. Medical treatment was sufficient in three cases. In the four other cases, PPV with IOL explantation and total capsular bag removal was conducted. Mean final BCVA was 20/160 with a gain of 4 lines and was ≥ 20/40 in 4 cases.

Conclusion: The diagnosis of CPE is still challenging especially for difficulties in isolating microorganisms. It should always be considered in cases of recurrent ocular inflammation resistant to conventional treatment in operated eyes. Non-conservative IOL surgical treatment may be directly necessary in severe cases.

Background

Chronic postoperative endophthalmitis (CPE) is a postoperatory infection, which is a very bad-known complication. Through the cases collected in this series, the literature review and summary of CPE was performed in order to summarize the clinical profile, treatment modalities, and visual outcomes in this rare intraocular infection.

Most of the culture-proven CPE case series are derived from laboratory results. Our series has the originality of recruiting patients from clinical suspicion after PKE+IOL. The diagnosis of CPE must first and foremost be clinical. Management begins with an eye sample for microbiological identification of the germ. Microbiological identification of the causative micro-organism is difficult to obtain: the main causes are the sequestration of germs in the capsular bag and the very slow growth of the germs most frequent in this infection. The only positive culture case that we observed in our series is that of an implant that was removed. A negative culture result does not rule out the diagnosis, and treatment will start upon clinical suspicion. In literature, the treatment is not codified. We propose a management algorithm. The first stage is a medical treatment, based on a "double-compartment approach" with the injection of antibiotics both intracameral, in the anterior segment and intra-vitreal in the posterior segment, associated to capsular bag (CB) washing. The second step is an IOL-conservative surgical treatment with pars plana vitrectomy (PPV) and partial CB removal. The third step is a non-conservative-IOL surgical treatment with re-PPV and complete CB removal and IOL explantation. In some severe situations, such as suspected or/and proven fungal or polymicrobial infection, first-line non-conservative-IOL surgical treatment may be necessary. At each stage of the patient's management, care should be taken to take samples of intra-ocular material again for microbiological identification of the causative germ.

Visual prognosis depends on severity of presentation and causative micro-organism.

Introduction

Infectious endophthalmitis is a rare complication occurring days, weeks or even years after cataract surgery (1,2). Chronic postoperative endophthalmitis (CPE) is defined as a delayed-onset intra-ocular inflammation occurring more than 6 weeks, months or even years after surgery. It is less common than acute endophthalmitis representing 12 % to 24% of post-operative endophtalmitis (3–6). CPE can present a diagnostic and therapeutic challenge. After phacoemulsification (PKE) and intraocular lens (IOL) implantation, it is characterized clinically by a delayed-onset of a chronic unilateral inflammation responding partially to topical steroids with phases of recurrence when treatment is interrupted. The presence of whitish capsular plaque (WCP) is the most frequent clinical feature (2,7). The most frequent causative microorganisms are staphylococcus epidermidis and propionic bacterium acnes (P.acnes), noted in 42,86% and 28,57% of cases by Moloney, respectively [5]. Their identification by culture of intraocular specimen facilitates the management of CPE, including medical and surgical therapeutic treatment depending on severity of clinical presentation (2,7,8). The purpose of this study was to describe the clinical features of CPE following uneventful PKE with IOL implantation and to highlight its treatment challenges in the absence of proven culture causative germ.

Materials And Methods

The current study was an observational retrospective case series, conducted over a 10-year period between January 2011 and June 2020, in the department of ophthalmology of Charles Nicolle's Hospital, a tertiary care center in Tunis. Patients with CPE after uneventful PKE with IOL implantation were included. CPE was defined by the following clinical features: history of chronic ophthalmic inflammation responding partially to topical steroids occurring at least 2 weeks after uncomplicated PKE, decrease of visual acuity after surgery, anterior chamber cells and white capsular plaque [7].

Prior ethics committee approval was obtained and the study was carried out in accordance with the tenets of the Declaration of Helsinki.

A chart review of medical and microbiological records of the included patients were reviewed and the following initial data was collected for each patient: age, gender, clinical features, interval between cataract surgery and diagnosis of CPE, interval between onset of signs and diagnosis of CPE, initial best corrected visual acuity (BCVA), details of slit-lamp examination, medical and/or surgical treatment, final BCVA and follow-up after treatment. All patients underwent,

before any treatment, under sterile conditions, an aqueous sampling (AS) with needle aspiration of aqueous fluid until flattening of the anterior chamber. At any time of follow-up, liquid or tissue or material taken from eye, such as aqueous humor (AH) collected before intraocular antibiotics (IOAB) injection, vitreous samples collected at the time of the therapeutic pars plana vitrectomy (PPV), tissues samples of removed capsular bag (CB), explanted IOL were processed for microbiological identification with special culture media and prolonged incubation time, with Gram Stain, inoculated into Blood, Chocolate and Sabouraud's Dextrose agar.

Treatment modalities were based on step-by-step management, depending on severity of CPE, results of microbiology and response to treatment (9,10). First line treatment for all patients was medical with a « two-compartment » approach of IOAB injection with systemic antibiotics (SATB). The IOAB was preceded by CB washing. It included simultaneous intracamelar vancomycine (1mg/0.1 ml) injection, and intravitreal antibiotics injection (IVAB) of vancomycine (1mg/0,1 ml) and ceftazidine (2,25 mg/0,1 ml). SATB consisted of intravenous cefazoline (3g/ day) and oral ofloxacine (400mg/day) during at least one week. Topic steroids were associated in all cases. This conservative medical treatment was repeated weeklywhen necessary in case of persistent or improved inflammation. Second and third line treatments were considered in case of worsening or persistent or recurrence of the inflammation during follow-up. The second line treatment was a conservative IOL surgical treatment with PPV. It was associated with partial posterior capsulectomy, irrigation of the CB and IOAB injection. The third line treatment was a non-conservative IOL surgical treatment, consisting in an IOL explantation with an additional PPV and a complete removal of the CB and IOAB injection. It may be considered as direct surgical procedure in severe cases. After a minimum follow-up of 3 months without recurrence of endophthalmitis, the infection was considered as resolved.

Results

Seven eyes from 7 patients were included in this study. Four patients underwent uncomplicated PKE and IOL in our department. The three other patients were operated elsewhere and referred to us, for management of a corticosteroid resistant uveitis with unknown etiology. There were four males and three females, with a mean age of 73.4 years (range: 61-83 years). Demographic data and clinical features of patients are summarized in Table 1. The mean interval between cataract surgery and the diagnosis of CPE was 30.7 weeks (range 2 -108 weeks). The mean duration of symptoms before diagnosis was 10.9 weeks (range 2 days-8 months). At presentation, all patients were under topic corticotherapy.

The mean initial BCVA was of 20/125, ranging from «counting fingers» (CF) to 20/50. Inflammation of the anterior chamber and fibrinous pupillary membrane were present in six cases (6/7) with keratic precipitates (KPs) in 4 cases (4/7), hypopion in one case (1/7). A white intracapsular plaque was observed in all cases (7/7 eyes) (fig 1-a, 2-a, 2-c, 2-d). Vitritis was noted in 3 cases (3/7). One patient (case n°2), a 61-old woman, had positive IOL culture of Enterococcus faecalis (E.Faecalis). She presented with a one-week history of visual loss, 5 weeks after PKE+IOL implantation in our department. On examination, her visual acuity was 1/100. The slim-lamp biomicroscopic examination revealed a moderate anterior uveitis with corneal edema, posterior IOL biofilm and vitritis at 3+. Ocular echography demonstrated moderate vitreous opacity.

In four patients (cases n°3, 5,6 and 7), medical treatment was sufficient and infection resolved after a single IOAB injection in 3 eyes (cases 3, 6 and 7) (fig 2-b, 2-e, 2-f) , and a second IOAB injection in 1 eye (case 5) (fig 2-d). In case 1, persistence of the WCP was noted after the third (fig 1-b) and the fourth (fig 1-c) IOAB injections. In three cases, intraocular inflammation didn't respond to medical treatment and a surgical treatment was required 8 days to 8 weeks after initial treatment. (Cases n°1, 2 and 4). In case 1, second line conservative-IOL surgical treatment was performed and followed by non-conservative IOL surgical treatment (Fig 1-d). In case 2 and 4, third line non-conservative IOL surgical treatment was performed directly following medical treatment. All treatment modalities are represented in table 2. Inflammation was resolved in all cases with a mean follow-up period of 39 months (range 12-80 months). Mean final BCVA was 20/160 with a gain of 4 lines (ranging from 1/80 to 20/32). In 4 cases, final BCVA was ≥ 20/40.

Discussion

In most cases of CPE, patients are referred for the management of a cortico-dependent anterior uveitis, as noted in 4/7 of our patients. According to Fardeau et al, the partially response to steroid represented one of the item of the definition of CPE (9). Typical clinical presentation is unilateral granulomatous uveitis involving the anterior chamber with a possible later progression into the vitreous. Most frequent ocular symptoms are a recurrent eye pain, a progressive decrease vision, a red eye, isolated or associatedto eye pain. An anterior chamber inflammation was present in 85,7% of our cases, with different grade of inflammation. Hypopion was noted in one of our cases, this clinical feature was reported by several authors in approximately 46% of the cases of CPE (8, 11-14). A white plaque on the anterior surface of the IOL or on the posterior capsule, was noted in all our patients, this finding was reported in 28.5% to 100% of CPE (11,14,15) and was found to be mostly associated with P.acnes (12,16–20). Others clinical features were noted in literature, suggesting fungal infection, such as a stirringly white infiltrates or clumps in the anterior chamber (16,21,22).

In this series the mean interval between cataract surgery and the diagnosis of CPE was 30.7 weeks. This interval was extremely variable in literature: 2 weeks, 3 weeks, 6 weeks (9,14,23,24), 3 months (12,13) or 6 months (25) . The mean time interval between cataract surgery and the diagnosis of CPE was relatively shorter in Onchobactrum Anthropi (O.anthropi) endophthalmitis and non tuberculous mycobacterium than in P. acnes endophthalmitis or Pseudomonas oryzihabitans, 6.8, 2, 36 and 16 weeks reported by previous studies, respectivelly (21,26) . This difference of delay, and the onset of clinical manifestations are probably related to average time of growth of the microorganisms (18,26,27).

In our study, AH culture was negative in 6 out of 7 patients, and only one case was culture-proven CPE, with an IOL microbiological diagnosis. The most cases series in literature provide from culture-proven cases from clinical and microbiology laboratory database (8,28–31). However, a negative culture result does not necessarily imply a bacteria-free infection (22,26,32). These results might be due to the nature of the cases being referred to our institution. These patients had been treated before being referred, thus the initial microbial profile might have been altered (33) . In addition, most of the microorganisms responsible for CPE are widely distributed in the natural environment, such as the water sources for O.anthropi, water and soil for Alacaligines faecalis or eyelid for P.acnes

(22,23,34). They are generally not virulent but the production of a biofilm on the artificial devices, such as in the surface of the IOL or on its haptics, may lead to these sequestration of microorganisms into the CB (1,13,17,17–20,32–36). Furthermore, vitreous taps have a higher rate of culture positivity than AS. However, in cases of negative cultures of both samples, the best result is the culture of the removed CB and IOL, as found in the single culture proven case of our series. Identification of the microorganism may need special culture media and prolonged incubation time. An aerobic and fungal culture is highly recommended (14,15). More recently, the role of molecular testing by polymerase chain reaction or "PCR", is essential, and allows a microbiological diagnosis in 71% of cases of postoperative acute and delayed-onset endophthalmitis as demonstrated by Chiquet (37–39). However, diagnosis based on clinical findings should be performed, without waiting for the microbiological results the to treat (22,29). E.faecalis was the only identified microorganism in our study. It is a gram positive bacterium that is part of the normal human gastrointestinal track flora (40,41). It is a relatively rare cause of endophthalmitis, found in 1.23% of acute post-cataract surgery endophthalmitis cases in the Endophthalmitis Vitrectomy Study (41,42). In a reported case series of E.faecalis endophthalmitis, the onset of clinical signs was within 4 days in 61,53%, between 4 days and 6 weeks in 7,69% and after 6 weeks in 19,23% of cases (36,41). As we noted in our series, it is usually related to a poor visual outcome with only 15% achieving a visual acuity better than 6/60, probably related to the bacterial virulence. Table 3 describes reported microbiological proven CPE after PKE and IOL implantation in literature (8,23,24,28,30–32,39,43–70)

The management of CPE is controversial. The sequestration of microorganisms into the CB, their different virulence proprieties and the possibility of polymycrobial infection have made it difficult to establish a unique protocol treatment (13,45). However, regardless of the clinical presentation and its severity, its management has to be prompt. A sample of intraocular fluid for microbiological investigation is mandatory in any suspected CPE before initiating treatment. In our series, the treatment of CPE was based on a "step by step approach". The first line treatment was medical, followed by the IOL-conservative surgical treatment, and the non-conservative-IOL surgical treatment, as recommended in literature (9,10,12). As described by Güler and Aldave, IOAB were based on a "two-compartment approach" that included a simultaneous injection in the humor aqueous and vitreous (71,72). Vancomycine (1mg/0.1 mL) and ceftazidim (2,25mg/0.1 mL) were used for empiric coverage of gram-positive and gram-negative organisms in the primary procedure (12,73,73). Ciprofloxacin (0.2 mg/0.1 mL) was used in non-responding cases and/or resistance to Ceftazidim (49,56). We performed an irrigation and washing of the CB, associated to the IOAB, as recommended in some studies (9,12). The use of SATB remains controversial (13,15,21,74,75). The slow growth of most common microorganisms isolated in CPE and their sequestration in the CB justify the need of repeated IOAB injection as we observed in cases n°3, 5, 6. (9,12,49,71). The association of steroids to IOAB injection and SATB administration depends on severity of inflammation and are proposed in different routes of administration. When inflammation recurs or increases, surgical treatment based on PPV is required to eliminate the contaminating foci, and may include two types of approaches, depending on whether the IOL is explanted or not. The IOL-conservative surgical treatment is generally associated to capsulotomy of the most infiltrated areas of the CB, and the IOL is preserved (1,10). This treatment strategy allows the removal of localized infectious sources while leaving enough capsular support for the IOL(26) . If the conservative-IOL surgical treatment is not efficient, as observed in our case 1, removal of the entire CB and the IOL is required to eradicate all sites of intraocular infection (9,13,15,17,19,23,26,27,34,43–48,73,76). Surgical treatments were observed in 50% of this case series, which agrees with other studies that reported it in approximately 30% to 73% of cases (12,15,16,27,41). A definitive initial surgical procedure should be considered in any patient with strong clinical evidence of severe or refractory CPE, or when the clinical features are suggestive or microbiologically proven aggressive microorganisms, such as fungal infection, Onchobactrum Anthropi, P.Acnes, or polymicrobial infection (15,22,26,34,45,52,72–74,77).

In this series, the mean final BCVA was 20/160 with a gain of 4 lines (ranging from 1/80 to 20/32), poor visual outcome was observed in case 2 and 4 where postoperative complications were noted such as CME (case 4) and ERM (case 2). The visual prognosis of CPE is various from one report to another, with a better visual prognosis than acute-onset endophthalmitis (16). Hsu et al noted that a long incubation (>1 month) would be associated with favorable visual outcomes compared to acute cases (18). However, CPE can lead to poor visual outcome despite the two-compartment approach of IOAB, and safe technics of complete non-conservative IOL surgical therapy, mainly related to the causative organism, specially fungal and/or nontuberculous mycobacterium infection (18,33,74). In another hand, polymycrobial infection has been associated with failure of IOL- conservative treatment (14,26,48,56,78).

Based on the literature, and the results observed in this study, we propose the following algorithm for the management of CPE (Table 3). First line treatment is medical, given at presentation and repeated if needed based on IOAB and associated to an AC and CB wash. If inflammation persists or recurs, the second step is an IOL-conservative surgical treatment, based on PPV, associated with CB partial removal and IOAB injection. The third step is a non-conservative-IOL surgical treatment, based on an additional PPV, associated to residual CB removal and IOL explantation. At any step of treatment, we start with an ocular sample for microbiological analyses, whether it concerns the intraocular fluids, humor and vitreous, CB or/and IOL when they have been removal. The surgical treatment is proposed as first line approach in particular situations (Figure 3).

The limitations of the current study include its retrospective design, a relatively small number of patients, the absence of performance of vitreous tap and inclusion of cases with negative aqueous humor cultures. Nevertheless, we addressed non-proven culture CPE after uneventful PKE, an issue that is encountered in our daily practice and we tried to extrapolate from our experience an algorithm that can help to manage such an entity.

Conclusion

The diagnosis of CPE is still challenging especially for difficulties in isolating microorganisms. It should always be considered in cases of recurrent ocular inflammation resistant to conventional treatment in operated eyes. The first diagnosis, based on clinical findings, should be performed to start a prompt management, beginning with ocular samples for microbiological diagnostic. Treatment is based on step-by-step approach. Medical treatment with intraocular antibiotic injections associated to capsular bag washing is efficient in most of cases. Nevertheless, first line non-conservative IOL surgical treatment may be necessary in severe cases associated to poor visual outcome.

Abbreviations

Antibiotic (AB)

Anterior chamber (AC)

antifongic medication (AF)

Aqueous humor (AH)

Aqueous sampling (AS)

Anterior uveitis (AU)

Best corrected visual acuity (BCVA)

Capsulectomy (C)

Capsular bag (CB)

Capsular bag removal (CB-R)

Counting fingers (CF)

Cystoid macular edema (CME)

Chronic postoperative endophthalmitis (CPE)

Case report (CR)

Case series (CS)

Enterococcus faecalis (E. Faecalis)

Epiretinal membrane (ERM)

Female (F)

Figure (Fig)

Hand movements (HM)

Intracameral antibiotics injection (ICAB)

Intraocular antibiotics (IOAB)

Intraocular lens (IOL)

Intraocular lens explantation (IOL-E)

Intravitreal antibiotics injection (IVAB)

Intravitreal antifongic injection (IVAF)

Intravitreal injection (IVI)

Light perception (LP)

Keratic precipitates (KPs)

Male (M)

No light perception (NLP)

Not reported (NR)

Not reported, we have only tha abstract (NR-AO)

Non-tuberculous mycobacterium (NTM)

Onchobactrum Anthropi (O.anthropi)

Propionibacterium acnes (P.acnes)

Phacoemulsification (PKE)

Pars plana vitrectomy (PPV)

Repeated pars plana vitrectomy (Re-PPV)

Systemic antibiotics (SATB)

Vitreous (V)

Visual acuity (VA)

Vitreous sample VS

Weeks (W)

Whitish capsular plaque (WCP)

Declarations

Ethics approval and consent to participate

Prior ethics committee approval was obtained by the Ethoc Commetty of Charles Nicoles University Hospital of Tunis.

The study was carried out in accordance with the tenets of the Declaration of Helsinki.

Consent for publication

Patients have given informed consent for the publication of their data and photo

Availability of data and material

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors'contributions

All authors contributed to the study conception and design.

- Material preparation, data collection and analysis were performed by Imene ZHIOUA BRAHAM, Hela KAOUAL, Imen AMMOUS, Khalil ERRAIES, Mejdi BOUKARI, and Raja ZHIOUA.
- The first draft of the manuscript was written by Ilhem MILI and all authors commented on previous versions of the manuscript.

All authors read and approved the final manuscript.

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Tables

Table 1: Demographic and clinical features of patients with chronic pseudophakic endophthalmitis

Case n°	Age/ gender	Interval surgery-diagnosis of CPE	Duration of symptoms	Patient provenance	Presenting BCVA	Anterior segment	Posterior segment	Culture
1 Fig 1a	83/M	5 months	4 months	Referred	1/100	KPs, AC cells 1+, Anterior and posterior IOL biofilm, posterior WCP	Hyalitis 2+	AH: Negative
2	61/F	5 weeks	1 week	Our department	1/80	Corneal edema, AC cells 3+,Hypopion, post and ant WCP	Hyalitis 3+	IOL: Enterococcus faecium
3 Fig 2a	81/M	2 weeks	2 days	Our department	20/200	AC cells 0,5+, Anterior IOL biofilm,	No hyalitis	AH: Negative
4	72/F	2 years	8 months	Referred	1/80	Mutton fat KPs, AC cells 2+, posterior WCP,	Hyalitis 2+, CME	AH+V+IOL: Negative
5 Fig 2c	73/F	5 weeks	3 days	Our department	20/100	KPs, AC cells 1+, anterior WCP	Normal	AH: Negative
6 Fig 2e	80/F	One year	2 months	Our department	20/50	Anterior WCP	Normal	AH: Negative
7	64/M	22 weeks	13 weeks	Referred	20/50	AC cells 1+, anterior WCP	Normal	AH: Negative

Abreviations: AC: anterior chamber. AH: aqueous humor. BCVA: best corrected visual acuity. CPE: chronic pseudophakic endophthalmitis. F: female. Fig: figure. IOL: intraocular lens. M: Male. KPs: keratic precipitates. V: vitreous. WCP: white capsular plaque.

Table 2 : Treatment strategies and outcomes of patients with chronic pseudophakic endophthalmitis

	INITIAL TREATMENT		SECOND AND THIRD LINE TREATMENT		Initial BCVA	Final BCVA
Case	First treatment	Number of IVI	Procedure	Delay of treatment		
1 fig 1b-1c-1d	ICAB+IVAB+SAB+irrigation of CB	4 weekly	1- PPV+ PC + IVAB + SAB 2-re-PPV+IOL-E + CB-R + IVAB ceftazidine (2,25mg) imipenem (0,5mg)	7 weeks 1 week	1/100	20/50
2	ICAB+IVAB + SAB	2 weekly	PPV+IOL-E+CB-R + IVAB	3 weeks	1/80	1/80
3 Fig 2b	ICAB+IVAB+SAB+ irrigation of CB	1only	0	0	20/200	20/25
4	ICAB+IVAB+SAB	2 weekly	PPV+IOL-E+CB-R+ IVAB	8 days	1/80	1/80
5 Fig 2d	ICAB+IVAB+SAB+ irrigation of CB	2 weekly	0	0	20/200	20/40
6 Fig 2f	ICAB+ IVAB+ SAB	1 only	0	0	20/50	20/32
7	ICAB+ IVAB+ SAB	1 only	0	0	20/50	20/25

CB: capsular bag. CB-R: capsular bag removal. CME: cystoid macular edema, ERM: epiretinal membrane. ICAB: intracameral antibiotics injection. IOL-E: intraocular lens explantation. IVAB: intravitreal antibiotics injection ; SAB : systemic antibiotics. IVI: intravitreal injection. PPV: pars plana vitrectomy.

Table 3 - Summary of cases of microbiologically proven chronic postoperative endophthalmitis, after uncomplicated phacoemulsification and implantation of posterior chamber intraocular lens in literature review

Report	Organism	Sample	Age/ sex	Cataract surgery to endoph diagnosis interval	Presentation	Treatment	
						Primary	Additional
Aaberg et al (CS) (43)	Achromobacter xylosoxidans	1-VS IOL 2-VS	1-70/F 2-89/F	1-NT 2-1 months	1-Chronic intraocular inflammation 2-Mild vitritis	1-PPV+ IOL-R+total 2-PPV+IOAB	1-IOAB
Saika et al (CR) (44)	Propionibacterium acnes	Removed CB	69/M	5 months	Chronic AU	PPV IOL-E CB-R	No
Rahman et al (45)	A. xylosoxidans + P. acnes.	AS VS	72/M	37 days	Chronic AU	IVAB	PPV+IOL-E
Ramaswany et al (CR) (46)	Mycobacterium chelonae,	Eviscerated tissue	66/F	3 weeks	Chronic panuveitis hypopion	IVAB SAB	Extensive scleral necrosis on the second dayà evisceration
Teichmann et al (CR) (23)	Propionibacterium acnes	Explanted IOL	52/M	20 weeks	Chronic AU	IOAB	IOL-E +CB wash out +IOAB +SAB
Lai et al 2006 (CR) (32)	Propionibacterium acnes	Explanted IOL	76/M	13 months	Acute AU WP	SAB	PPV+IOL-E
Matieli et al (CR) (47)	Mycobacterium abscessus	VS	76/F	3 weeks	corneal abscess in the incision, hypopyon, and severe vitritis	PPV+IOAB	PPV+IOAB+IOL-E
Nehemy et al (CR) (48)	Verticillium Species	VS	60/M	6 months	Chronic AU WP	PPV IVAB+ amphotericine B	Re-PPV CB-R IOL-E
Song et al (CS) (26)	-Ochrobactrum anthropi in 7 cases	VS (7/9) AS+VS(3/9)	Average = 68 years 7F/2M	Average = 6,8 weeks	AU (9/9), Vitritis (8/9) Hypopyon (6/9) Fibrinous pupillary membrane (3/9)	IVAB	PPV+C
	Ochrobactrum anthropi+ Propionibacterium acnes	VS +IOL-E				IVAB+PPV+C	Re-PPV (x2) +C-R +IOL-E
	Ochrobactrum anthropi+ Propionibacterium acnes	VS +IOL-E				IVAB+PPV+C	Re-PPV (x2) +C-R +IOL-E

Peponis et al (CR) (49)	Actinomyces meyeri	VS	65/F	2 weeks	Acute AU Biofilm on AS/IOL	PPV +CB wash out, +C	no
Hayashi et al (CR) (27)	Propionibacterium acnes	Explanted IOL	77/F	4 weeks	Acute granulomatous AU with hypopion	PPV +AC wash + C +IOAB +SAB	re-PPV + CB-R+ IOL-E+IOAB
Pal et al 2013 (1 case in a CS) (36)	Alcaligenes Faecalis	VS	67/F	3 months	Chronic AU Hypopion Iris neovascularization	PPV +IVAB	IVAB (x2)
Nagaraj et al (CR) (50)	Pseudomonas aeruginosa	AS	65/M	6 months	Chronic AU	IVAB (ciprofloxacin : 0.2 mg/0.1 mL) + SAB + IVS	IVAB
Pichi et al 2014 (CS) (48)	S.Epidermidis	VS	90/F	2 months	Acute AU Fibrine around IOL and capsule	IVAB	1-IVAB+IVS. 2- PPV+CB-R+IOL-E+IVAB
	S.Epidermidis	VS	55/F	3 months	Chronic AU hypopion	IVAB	1-IVAB+IVS. 2- PPV+CB-R+IOL-E+IVAB
Vinekar et al 2014 (CS) (52)	Candida glabarata	VS	45/M	3 weeks	Chronic AU +Fibrin over IOL +Vitritis	ICAFIVAF +PPV	Re-PPV(2) +Annular keratoplasty +IOL-E+IVAF
	Yeast (smear)	VS	66/F	6 weeks	Chronic AU +hypopion + vitritis	ICAF+IVAF + oral voriconazole PPV	PPV(3) +IVAF
Hung et al 2014 (CS) (24)	Mycobacterium abscessus	VS	67/M	3 months	moderate AU +hypopyon +WP +severe vitritis	PPV+IOAB+IVS	IVAB(x4) Scleral necrosis
Kanjeen et al (CR) (53)	Ochrobactrum anthropi,	AS	60/F	1 month	Chronic granulomatous AU	IOAB +SAB	IOAB +SAB device-explantation
Shah et al (CS) (31)	NTM	VS	76/M	Mean for all cases = 9 weeks	Low grade chronic AU	PPV+IOAB+C	Re-PPV(x2) +IOL-+IOAB+IVS
		VS	71/F		Low grade chronic AU	PPV+IOAB	Re-PPV +IOL-E
		VS	69/F		Low grade chronic AU	PPV+C+IOAB+SAB+IOL-E	no
		VS	53/F		Low grade chronic AU	IOAB+SAB	Re-PPV (x4) +IOL-E
Paulose et al (CS)	NTM	VS	69/F	90 days	Hypopyon, exudative membrane on IOL, vitritis	PPV+IOAB	Evisceration

(30)							
Ercan et al (CR) (54)	Pseudomonas specie	VS IOL-E	65/F	9 months	Chronic AU Hypopion	PPV IOL-E IVAB	Re-PPV SAB
Venkat et al (CR) (55)	bacterium Aquamicrobium terrae	AS VS	61/M	NR	Chronic AU	IVAB Oral AB	PPV IOL-E CB-R
Roy et al (CR) (56)	Acinetobacter baumanni	VS	74/F	15 days	Acute AU Hypopion Exsudative membrane over IOL	PPV +IOL-E IVAB (ciprofloxacine)	IVAB(x2) Subretinal abcess
Palioura et al (CR) (57)	Candida parapsilosis	VS	62/F	7 months	Chronic AU +Hypopion +White fluffyappearing deposits between the IOL and the capsular bag	ICAF +IVAF + AC washout + SAB	PPV+CB-R + IOL-E + ACAF +IVAF + systemic AF
Al-Mezaine et al (CS) (8)	P .Acnes	NR	64/M	5 months	KPs	IVAB +IVS	none
	P .Acnes	NR	63/M	4 months	KPs	IVAB +IVS	PPV +IOL-E +CB-R
	S auricularis	NR	61/F	2 months	WP	Repeated IVAB +IVS	none
Murata et al (CR) (62)	bachibacterium	AS VS	57/M	17 weeks	Chronic low grade AU	Repeated IOAB +IVS	None
Voon et al (CR) (58)	Pseudozyma aphidis	VS	46/M	6 weeks	Chronic low grade AU +ME	ICAF +IVAF + AC washout + SAB	PPV+C +IVAF +systemic AF
Gokhale et al (CR) (59)	Escherichia fergusonii	VS and PCR	72/F	4months	Chronic severe AU +hypopion	Repeated IOAB +IVS	PPV +IOL-E +CB-R
Ruiz-Moreno et al (CR) (60)	Hafnia Elvei	VS	68/F	3 months	Severe chronic panuveitis with retinal vasculitis	IVAB +SAB	acute proliferative vitreoretinopathy
Seo et al (CR) (63)	Sphingomonas paucimobilis	VS by PPV	62/M	3 months	Severe acute panuveitis	IVAB	PPV IOL-E CB-R +IVAB+SAB +systemic steroid
Spencer et al (CR) (64)	Mycobacterium goodii	VS by PPV	67/M	4 weeks	Moderate AU	IVAB +IVS	PPV (x2) IOL-E CB-R

							+IVAB+SAB
Villegas et al (CS) (65)	A.xylosoxidans	VS by PPV	62/M	3 months	moderate AU +hypopion	PPV+IVAB	Re-PPV +C+IOL-E +IVAB +IVS
Macarez et al (CR) (66)	negative	AS	77/F	5 weeks	Moderate AU +WP +vitritis	IVAB +SAB	IOAB+SAB
Al-Abri et al (CR) (67)	scedosporium apiospermum	VS	45/F	3 months	Severe AU +hypopion +vitritis	IVAB +SAB	PPV (x2) +C+IOL-E +IVAB +IVS +oral AF+IVAF
Chen et al (CR) (68)	Roseomonas	VS	83/F	8 months	Severe AU +hypopion	IVAB +SAB	PPV +IVAB
Hesse et al (CS) (69)	Enterococcus faecalis	AS+VS	70/M	3 weeks	Moderate AU +WP	PPV +C+IOL-E +IVAB	IVAB
Uy et al (CR) (70)	Peseudomonas luteola	VS+IOL-E	61/F	4 months	Severe AU +hypopion +hyalitis	PPV +C+IOL-E +IVAB	IVAB
Kuriyan et al (CS) (28)	Enterococcus faecalis	AS+VS	78/F		Moderate AU	IVAB +SAB	PPV +C +IVAB
	Enterococcus faecalis	VS	64/M	2 weeks		IVAB	PPV

Abbreviations : *AB* : antibiotic. *AC* : anterior chamber.. *AF* : antifongic medication. *AS* : aqueous sample. AU : anterior uveitis. *C* : capsulectomy. *CB* : capsular b bag removal. *CF* : count fingers. *CR* : case report. *CS* : case series. *F* : female. *HM* : hand movements *ICAF* : intracameral antifongic injection. *IOAB* : intraocul antibiotic injection. *IOL* : implantated intraocular lens. *IOL-E :* intraocular lense explantation. *IVAB* : intravitreal antibiotic injection. *IVAF* : intravitreal antifongi steroids injection. *KPs* : keratic precipitates. *LP* : light perception. *M* : male. *NLP* : no light perception. *NR* : not reported. *NR-AO* : not reported, we have only tha tuberculous mycobacterium. *PPV* : pars plana vitrectomy. *Re-PPV* : repeated pars plana vitrectomy. S*AB* : systemic antibiotics. *VA* : visual acuity. *VS* : vitreous whitish plaque on the lens capsule.

Figures

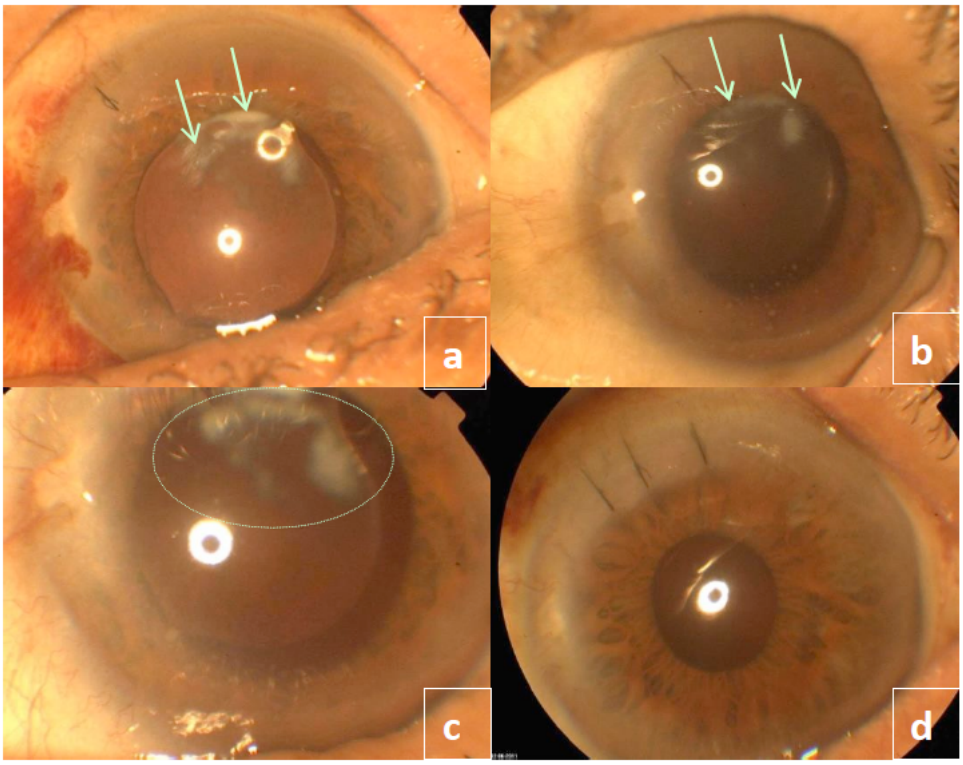

Figure 1

Case 1: An 83-year-old male patient, with white plaque between intraocular lens and posterior capsule, presented with marked anterior segment inflammation and vitritis (case 1). a : At presentation, BCVA 1/100: Anterior and posterior biofilm on capsular bag (green arrows). Persistence of the white capsular plaque after 3 (b) and 4 (c) IOAB (green circle). Total resolution of inflammation after second line non-conservative surgical treatment, BCVA 20/50 (d).

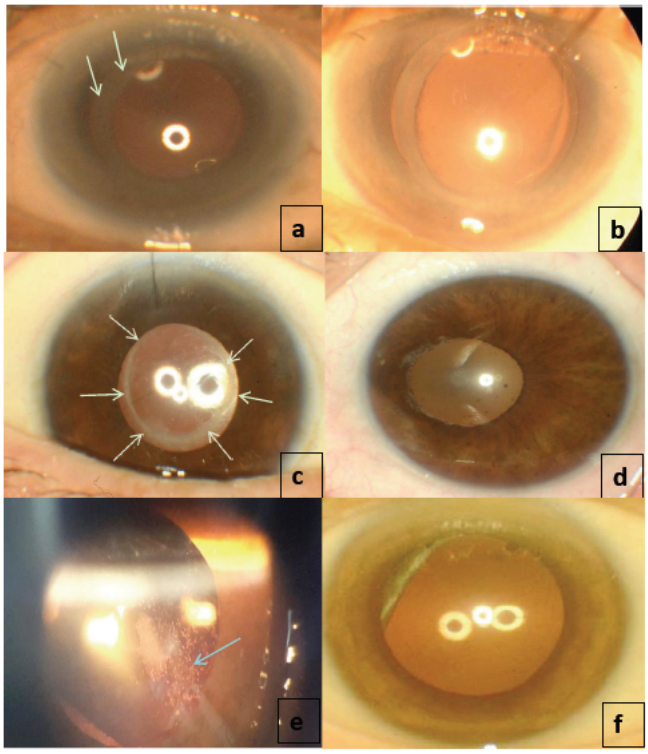

Figure 2

Case 3 (a and b): An 81-year-old, pseudo phakic male patient presented with low-grade ocular inflammation due to a presumed chronic postoperative endophthalmitis with negative-culture humor sample. a: Before treatment, BCVA 20/200: Anterior intraocular implant biofilm (green arrows). b: After one intraocular antibiotics injection and systemic antibiotic associated with irrigation of capsular bag with antibiotics, improvement of anterior inflammation, BCVA 20/25. Case 5 (c and d): A 73-year-old, pseudo phakic female patient presented with low-grade ocular inflammation due to a presumed chronic

postoperative endophthalmitis with negative-culture humor sample. c: Before treatment, BCVA 20/100: anterior intraocular implant biofilm. d: After 2 intraocular antibiotics injection associated to capsular wash and systemic antibiotic, improvement of anterior inflammation and BCVA 20/40. Case 6 (e and f) :An 80-year-old, pseudo phakic female patient presented with low-grade ocular inflammation due to a presumed chronic postoperative endophthalmitis with negative-culture humor sample. e- Before treatment, BCVA 20/50: Low-grade anterior uveitis and an anterior white capsular plaque (blue arrow). f- After first-line medical treatment: Improvement of anterior inflammation and cleaning of the intraocular lens surface, BCVA 20/32. Abbreviations: BCVA: best-corrected visual acuity, IOAB: intra-ocular antibiotics.

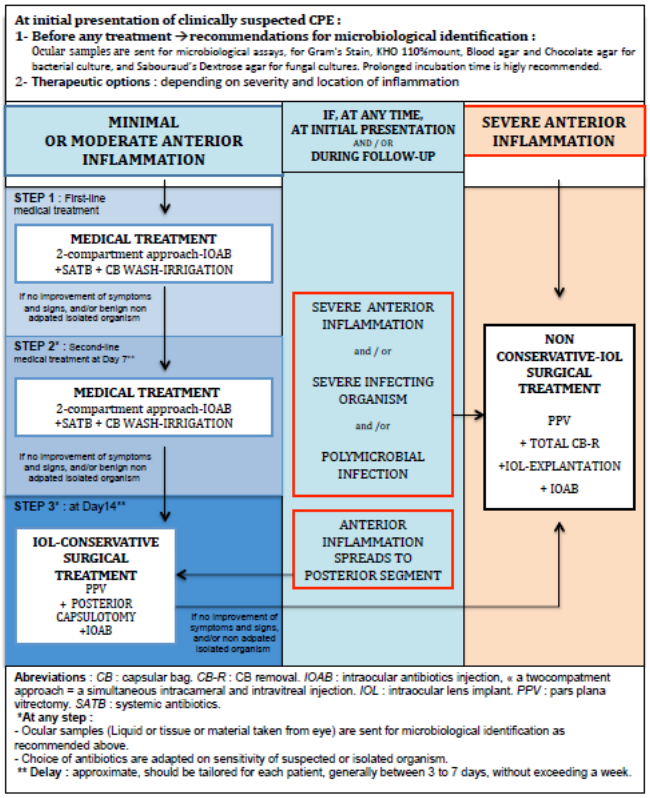

Figure 3

Algorithm of chronic postoperatory endophthalmitis, after unventfull phakoemulsification and intraocular lens, with : (1) Recommendations for ocular samples for microbiological identification. (2) Therapeutic options, depending on severity and location of inflammation at initial presentation.