Management of Intraocular Foreign Bodies in the Posterior Segment: 10 Years Real World Analyses

Tratamento de Corpos Estranhos Intra-Oculares no Segmento Posterior: Análise de 10 Anos de Vida Real

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ABSTRACT

INTRODUCTION: Ocular traumas with intraocular foreign bodies (IOFB) can have serious ocular complications, such as retinal detachment and endophthalmitis that can greatly affect the visual outcome. Pars plana vitrectomy (PPV) is the most commonly used technique to remove IOFB from the posterior segment. The purpose of this study was to evaluate the management and outcomes of posterior segment IOFB in a tertiary ophthalmology center.

METHODS: Patients that suffered a penetrating eye injury with IOFB retained in the posterior segment who underwent PPV for IOFB extraction between 2010 and 2020 were included and data was collected from patients' archives.

RESULTS: Thirty eight patients with mean age of 48.68 years old were included, 86.8% were males. A percentage of 59.5% came to the ophthalmology emergency at the same day of the accident, but 16.2% took 3 days or more to seek medical help. The most common complications on initial examination included traumatic cataract (52.6%), retinal lesions (34.2%) and hyphema (23.7%). Also, before IOFB extraction, 42.1 % of patients developed endophthalmitis. Systemic antibiotics was administered to 84.2% of patients and 71.1% received intravitreal antibiotics. Comparing the 15.8% of eyes that ended up developing phthisis bulbi with those who did not, the only statistically significant difference (p<0.01) was the time between first ophthalmological contact and PPV, that was superior on the phthisis bulbi group. The development of endophthalmitis was not significantly related to a delayed surgery, nor to the use of intravitreal or systemic antibiotics.

CONCLUSION: Most of our patients had traumas that occurred in an agricultural setting which usually gives rise to dirty wounds and probably contaminated IOFB. This fact could possibly justify our rather high rate of 42% of endophthalmitis (which is, nonetheless, within what is described in literature). Despite the advances in systems of visualization, equipment and materials for vitreoretinal surgery, penetrating trauma with IOFB still present a very poor prognosis in terms of visual function.

KEYWORDS: Endophthalmitis; Eye Foreign Bodies/complications; Eye Injuries, Penetrating/complications; Vitrectomy.

RESUMO

INTRODUÇÃO: Os traumatismos com corpos estranhos intraoculares (CEIO) podem ter complicações graves, como descolamento de retina e endoftalmite, que podem afetar muito o prognóstico visual. A vitrectomia via *pars plana* (VPP) é a técnica mais utilizada para remover CEIO do segmento posterior. O objetivo deste estudo foi avaliar os resultados do tratamento dos CEIO no segmento posterior num centro terciário de oftalmologia.

MÉTODOS: Incluíram-se os doentes com traumatismo ocular penetrante associado a CEIO retido no segmento posterior que foram submetidos a VPP para extração do CEIO entre 2010 e 2020. Os dados foram colhidos dos processos clínicos dos doentes.

RESULTADOS: Foram incluídos 38 doentes com idade média de 48,68 anos, 86,8% eram do sexo masculino. Foram à urgência no dia do acidente 59,5%, mas 16,2% demoraram 3 dias ou mais recorrer ao hospital. As complicações mais comuns ao exame inicial foram catarata traumática (52,6%), lesões retinianas (34,2%) e hifema (23,7%). Além disso, antes da extração do CEIO, 42,1% dos doentes desenvolveram endoftalmite. Foi administrado antibiótico sistémico a 84,2% dos doentes e 71,1% receberam antibióticos intravítreo. Comparando os 15,8% dos olhos que acabaram por desenvolver *phthisis bulbi* com os restantes, a única diferença estatisticamente significativa (p <0,01) foi o tempo entre o primeiro contato oftalmológico e a VPP, que foi superior no grupo com *phthisis bulbi*. O desenvolvimento de endoftalmite não teve relação com maior tempo para VPP, nem com o uso ou não de antibióticos intravítreos ou sistémicos.

CONCLUSÃO: A maioria de nossos doentes teve traumatismos em contexto agrícola, que geralmente dão origem a feridas mais sujas e CEIO provavelmente contaminados. Isto pode justificar a nossa taxa elevada de 42% de endoftalmites (que está, no entanto, dentro do descrito na literatura). Apesar dos avanços nos sistemas de visualização, equipamentos e materiais para cirurgia vitreorretiniana, o traumatismo penetrante com CEIO ainda apresenta um prognóstico muito mau em termos de função visual.

PALAVRAS-CHAVE: Corpos Estranhos no Olho/complicações; Endoftalmite; Ferimentos Oculares Penetrantes/complicações; Vitrectomia.

INTRODUCTION

Intraocular foreign bodies (IOFBs) are a serious form of ocular injury, accounting for 17% to 41% of penetrating ocular injuries.[1] They can enter through the cornea (the majority), sclera, or at the limbus and most reside in the posterior segment, but they can also be lodged in the anterior chamber or lens.[2,3] Around 85% of these IOFBs are metallic but they can also be composed of organic material, glass, plastic, or others.[1,2]

A detailed yet focused history, careful examination of the anterior and posterior segment at the slit lamp and by ophthalmoscopy and certain imaging diagnostic tests should allow the ophthalmologist to make the diagnosis.[3] When an IOFB is suspected the ophthalmologic examination must be done carefully because there may only be faint signs such as focal lens opacities, iris transillumination defect, small self-sealing wounds, subconjunctival hemorrhage, chemosis or positive Seidel test.[2] In order to confirm the presence of an IOFB, nowadays, plain x-ray is being replaced by computed tomography (CT) as the primary radiological diagnostic tool, but sometimes, when the IOFB is not radio-opaque, ultrasound or magnetic resonance imaging (MRI) may be needed.[3]

Intraocular foreign bodies can cause direct mechanical damage along their path of entry into the eye and can have a significant risk of associated post-traumatic endophthalmitis, that can cause pain, progressive visual loss, hypopyon, and vitritis.[2]

Pars plana vitrectomy (PPV) is the most commonly used technique to remove IOFBs from the posterior segment. The purpose of this study was to evaluate the management of posterior segment IOFB in our department, as well as the clinical characteristics, complications, and globe survival after IOFB extraction via PPV.

METHODS

This is a retrospective cohort study from a tertiary ophthalmology center and surgical retina reference center, in Portugal.

Patients that suffered a penetrating eye injury with IOFB retained in posterior segment who underwent PPV for IOFB extraction between 2010 and 2020 were included. All patients were operated by the same surgeon. Patients with IOFB in the anterior segment or lens were excluded.

We collected data from patients' archives, namely: pa-

tient's demographic data, diagnostic tools, pre-surgical complications and management, timing of the first ophthalmologic examination and timing of PPV, surgical procedures, post-surgical complications, visual outcome, and globe survival. All statistical analyses were performed using SPSS statistical software (SPSS, Inc., Chicago, IL, USA). Non-parametric Mann-Whitney test was used to evaluate differences between groups. A p value of 0.01 or less was considered statistically significant.

RESULTS

Thirty-eight patients (38 eyes) were included, 86.8% males and 13.2% females. Their mean age was 48.68 years old. The affected eye was the right on 58% of cases. The activity most often mentioned at the time of the trauma was agriculture (37%).

Most of the patients (59.5%) came to the ophthalmology emergency the same day of the accident, 24.3% came at day 1 or 2 post-trauma and 16.2% took 3 days or more to come to the hospital.

The diagnosis of IOFB was confirmed by CT-scan on 83.3% of the cases. A percentage of 8.3% were confirmed by radiography, 5.6% by ultrasound, and 2.6% by MRI. The nature of the IOFB was not registered but, except for one, all the others were radiopaque.

The entry wound location was the cornea on 54.3% of cases, on 34.2% it was the sclera, on 7.9% it was limbic, and on the remaining patients it was not mentioned in the patient' archives. In some patients, the IOFB did several lesions through its route. Initial examination findings included traumatic cataract on 52.6% of patients, vitreous hemorrhage on 13.2%, 34% patients had retinal lesions but only 10.5% had retinal detachment (RD). Hyphema was present on 23.7% of patients, iridodialysis on 5.3% and 2.6% had iris incarceration at the corneal wound. Also, 42.1% of patients developed endophthalmitis before IOFB extraction. This result was not linked to the timing of PPV, the use of systemic or intravitreal antibiotics, nor to the performance of primary wound closure (p>0.01).

Most patients (84.2%) received systemic antibiotics before IOFB extraction, 63.2% received intravenous ceftazidime and vancomycin, and 15.8% received oral ciprofloxacin. One patient (2.6%) received only ceftazidime due to vancomycin allergy and one other received vancomycin and voriconazole due to a suspicion of fungal infection. In what concerns intravitreal antibiotics before IOFB extraction surgery, 71.1% of patients received at least one injection of ceftazidime and vancomycin.

Only one patient underwent immediate surgery to extract the IOFB. From the remaining, only 45.9% had primary closure of the wound. The surgery for extraction of IOFB was performed on a median of 6 days after first ophthalmological contact (interquartile range-IQR: 6). All patients had a PPV, of these, 84.2% also had a combined cataract surgery. During 10.6% of surgeries (4 patients) the IOFB was not visualized. For tamponade, silicone oil was used on 28.9%, C3F8 on 7.9%, SF6 on 5.3% and air on 2.6% of eyes. The remaining 55.3% were left with balanced salt solution in vitreous chamber. In one patient it was not possible to correct the RD. The post-operative complications included proliferative vitreoretinopathy (PVR) on 15.8%, retinal detachment on 21.1%, epiretinal membrane on 5.3%, cataract on 7.9%, choroidal detachment on 7.9%, vitreous chamber hemorrhage on 5.3% and IOL luxation on 2.6%. Subsequently, 42.1% of patients needed more surgeries, such as other PPV due to PVR, or cataract surgery.

Most of those who underwent cataract surgery had an intraocular lens (IOL) implanted, 21.1% had a monobloc IOL in the capsular bag, 18.4% a three-pieces IOL in the sulcus, and 10,5% had a retropupillary iris-claw IOL. The remaining 34.2% were left aphakic.

For 15.8% of patients the eye ended by developing phthisis bulbi. Comparing these eyes with those who did not develop phthisis bulbi, the only statistically significant difference (p<0.01) found was the time between first ophthalmological contact and surgery for IOFB extraction, that was superior on the phthisis bulbi group, with a median of 13 days (IQR: 17.75). Interestingly, the rate of endophthalmitis was not superior on the ones who ended up in phthisis bulbi than in those who did not. The development of endophthalmitis was not related to a superior time before surgery, nor to the use of intravitreal or systemic antibiotics.

In what concerns visual acuity more than 6 months after surgery we only had records from 28 patients. From these, 36% did not have light perception, 28.6% had less than 1/10, 14.3% had between 1/10 and 5/10 and 21.4% had more than 5/10 on the Snellen chart. These visual acuities were not statistically related to a superior time before surgery, nor to the use of intravitreal or systemic antibiotics, the entry wound location, or the appearance of endophthalmitis (p>0.01), but they seem related with the visual acuity at presentation.

DISCUSSION

Ocular traumas with IOFBs still have serious ocular complications, such as RD and endophthalmitis that can greatly affect the visual outcome. IOFBs can serve as a vehicle for infectious organisms and the rate of IOFB related infectious endophthalmitis ranges from 0%-48.1% in various studies with a higher rate in patients with retained IOFB composed of organic materials.[2] For this reason, all eyes with signs of endophthalmitis or high risk (such as injuries in rural setting with the potential of soil contamination) should have a globe repair with immediate IOFB removal. If a vitreoretinal surgeon is not available, it may be better to delay IOFB removal. This delay can help improve control of inflammation caused by initial open globe injury and it can also allow adequate time to assemble appropriately skilled operation room personnel and necessary surgical equipment.[3]

Recent studies have also reported delayed IOFB removal not influencing the final visual outcome, as long as the lacerated wound is repaired promptly, and prophylactic antibiotics are prescribed.[4] The patient can then be referred

expeditiously to the specialist for definitive treatment of IOFB removal.[2]

Prophylactic systemic broad spectrum intravenous antibiotics have not been proven to be effective, but they are often used, especially when prompt IOFB removal is not possible.[1,3] Many studies failed to prove the importance of intravitreal antibiotics to prevent endophthalmitis development and its prophylactic use is controversial.[1,3,5] Despite the conflicting evidence, some authors recommend using prophylactic intravitreal antibiotics especially in ''high-risk'' cases.[1,3,4] Essex *et al*[1] recommend consideration of prophylactic intravitreal antibiotics if at least two of the following three risk factors are present: 1) delay in primary repair of ≥ 24 hours, 2) dirty wound, or 3) lens breach.[2]

The most frequently mentioned activity at the time of trauma was agriculture (37%) which usually gives rise to dirty wounds and probably contaminated IOFBs. This fact could possibly justify our rather high rate of 42% of endophthalmitis (which is, nonetheless, within what's described in literature). The incidence of endophthalmitis in our study was not statistically significantly linked to the timing of PPV, the use of systemic or intravitreal antibiotics, nor to the performance of primary wound closure, which makes us think that it could be related to the IOFB characteristics and contamination. Unfortunately, as this is a retrospective study, it was not possible to characterize the nature of these foreign bodies, that was not included in the patients' archives.

On the other hand, we verified that the timing of PPV was statistically superior in those who ended up developing phthisis bulbi than in those who did not. This delay, in most cases, was perhaps and probably related to the inflammation and lack of corneal transparency. These characteristics are probably signs of greater ocular destruction, possibly related to a bigger kinetic energy and bigger dimensions of the IOFB, leading to a greater and more prolonged inflammation.

In our emergency room we do not have the vitreoretinal surgeons, nor the equipment needed to do immediate PPV, so we should do immediate wound closure, what was not always verified, because the wound was often of little size, with spontaneous closure. Apart from endophthalmitis, our patients also presented other factors that have been reported as predictive of poor visual outcome,[2,4] such as presentation with hyphema (23.7%) or vitreous hemorrhage (13.2%). However, none of these were related to the visual outcome or phthisis bulbi formation.

We conclude that, despite the advances in the systems of visualization, equipment and materials for vitreoretinal surgery, penetrating trauma with IOFB, especially if resulting from agricultural activity, still presents a very poor prognosis in terms of visual function. For a better comprehension of the visual outcomes, it could be interesting to better characterize the nature and dimension of the IOFB from now on.

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CX: Conceptualization, Data collection, writing the article.

RSP, AM: Data collection, Investigation.

JB: Conceptualization, Investigation, Supervision.

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