Review

Rational Drug Use in Extraocular Surgeries

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Abstract

Extraocular surgeries include a broad spectrum of procedures such as pterygium excision, removal of conjunctival tumors, and orbital exenteration. The objective of these surgeries is to address various ocular conditions, enhance visual function, and rectify cosmetic concerns. Nonetheless, as with any invasive procedure, these surgeries carry a risk of infection. To curtail this risk, prophylactic antibiotics are commonly used after extraocular surgeries. Administered via topical, oral, or intravenous routes, these antibiotics aim to prevent potential postoperative bacterial infections. The selection of these antibiotics is guided by their efficacy against prevalent pathogens associated with ocular infections, including *Staphylococcus epidermidis* and *Pseudomonas aeruginosa*. The choice of antibiotic, its route of administration, and duration of therapy can vary depending on the specifics of the surgery and individual patient risk factors. Moreover, in the context of extraocular surgeries, specific agents such as mitomycin C (MMC), interferon (IFN) alpha-2b, and 5-fluorouracil serve unique roles extending beyond infection prevention. MMC, an antitumor agent, aids in averting scarring and fibrosis in procedures like pterygium and glaucoma surgeries. IFN alpha-2b, with its antiviral and antiproliferative properties, is utilized to decrease the recurrence of conjunctival and corneal neoplasias postoperatively. This review examines the current understanding of prophylactic antibiotic use in certain extraocular surgeries and the role of antibiotics and some specific agents in enhancing surgical outcomes.

Keywords: Extraocular surgeries, prophylactic antibiotics, mitomycin C, interferon alpha-2b, 5-fluorouracil, amphotericin B

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Introduction

Prophylactic antibiotics, also termed preventive antibiotics, represent a class of pharmaceutical agents primarily employed not for the treatment of established infections, but rather for their prevention. They are frequently utilized in the context of surgical procedures, administered before, during, or after the operation to minimize the risk of postoperative infections. Additionally, they may be employed in other circumstances characterized by elevated infection risk.

The selection of prophylactic antibiotic is multifactorial, determined by the nature of the infection being forestalled, the bacterial species most likely implicated, and patient-related factors such as allergic history and concurrent medical conditions. A few representative examples of these antibiotics include cefazolin, vancomycin, and gentamicin.[1]

Antibiotic prophylaxis, employed in numerous scenarios and through diverse routes of administration, is a wide-ranging domain encompassing fluoroquinolones and aminoglycosides, among others. The selection of prophylactic agents and administration routes, such as topical, subconjunctival, oral, and parenteral, depend closely on the timing of administration, which could be preoperative, intraoperative, perioperative, or postoperative. In support of this, a survey conducted by the American Society of Cataract and Refractive Surgery in 2014 reported that 90% of surgeons employed topical antibiotics perioperatively and 97% opted for their use postoperatively.[1]

These prophylactic measures aim to prevent infections predominantly caused by Gram-positive organisms, including coagulase-negative *Staphylococcus*, *Streptococcus viridans*, and *Staphylococcus aureus*. Gram-negative organisms such as *Pseudomonas* or *Haemophilus*, though less common, also warrant prophylaxis, while fungi and *Nocardia*, being rare, require it less frequently.[1]

However, it is crucial to deliberate the potential risk associated with prophylactic antibiotic usage-the theoretical threat of engendering bacterial antibiotic resistance following prolonged and repeated administration, a concern of significant clinical relevance in contemporary medicine.[1]

Additionally, it is important to shed light on the importance of the incorporation of specific agents like mitomycin C (MMC), interferon (IFN) alpha-2b, 5-fluorouracil (5-FU), and amphotericin B into extraocular surgical protocols, which has significantly enhanced the treatment and management of various ocular conditions. MMC for instance, an antineoplastic agent, has found utility in ocular surgeries for its inhibitory effects on fibroblast proliferation, thus preventing postoperative scarring and fibrosis.[2] IFN alpha-2b, though not an antibiotic in the classical sense, has potent antiviral and antiproliferative properties, and has been successfully employed in the management of ocular surface squamous neoplasia.[3] Amphotericin B, a potent antifungal agent, is indispensable in the treatment of sino-orbital fungal infections and is often used in conjunction with surgical debridement for effective disease control.[4] These agents signify the diverse roles antibiotics can play in improving the outcomes of extraocular surgeries, beyond their traditional role in infection control.

In extraocular surgeries, the use of prophylactic antibiotics and certain special agents is very important to prevent infections and improve surgical results. When planning treatment, patient factors, surgical procedure, and the auxiliary agents to be used should be evaluated together. In this review, we evaluated the accepted use in the literature of antibiotics used for prophylaxis in extraocular surgeries and some specific agents used to improve surgical outcomes.

Prophylactic Antibiotic Use in Extraocular Surgeries

The field of extraocular surgery encompasses a broad range of interventions, including strabismus correction, pterygium excision, and retinoblastoma treatment. Other operations involve enucleation for malignancies and repair of ocular trauma. In this complex field, the application of antibiotic prophylaxis to prevent surgical site infection (SSI) presents a considerable challenge that varies for each case and disease.

In a multicenter retrospective study evaluating the development of SSI after various oculoplastic surgical procedures performed on 947 eyes of 795 patients, the patients were divided into two groups. The first group included patients who received postoperative local antibiotic ointment (LATB group) (505 patients, 617 procedures) and the second group included patients who received no postoperative local antibiotics (LATB-free group) and only topical vitamin A ointment (229 patients, 330 procedures). No patient received postoperative eye drops. Eight hundred and fifty-three procedures were classified as Altemeier class 1 (clean) and 80 procedures as class 2 (clean-contaminated). Postoperative SSI was seen in 4 of 617 eyes (0.65%) in the LATB group and 5 of 330 eyes (1.52%) in the LATB-free group, and there was no statistically significant difference between the groups. This study suggests that it is appropriate to perform oculoplastic surgery without the use of systemic and topical antibiotics in Altemeier class 1 and 2 procedures.[5]

Strabismus Surgery

Strabismus surgery, a common extraocular procedure with a low incidence of major complications, necessitates postoperative management to curtail infections and alleviate inflammation. The postoperative antibiotic regimen varies based on surgeon preference, with most opting for antibiotic/steroid combinations and a minority using topical antibiotics. Recently, a single postoperative dose of povidone-iodine has been explored as an alternative.[6]

In a non-comprehensive study including 1,603 patients, pediatric ophthalmologists either employed a single dose of 5% povidone-iodine (n=953) or continued the traditional week-long topical antibiotic/steroid course at a frequency contingent on surgeon preference (n=650).[6] Fornix incisions were performed in 1,074 patients, limbal incisions in 467, and a combination of both in 62. Signs and symptoms suggestive of postoperative infection were observed in 46 patients (2.87%). Of these, 20 (3.08%) were from the antibiotic/steroid group, and 26 (2.83%) from the povidone-iodine group. The study's outcomes suggest no significant difference in infection rates between the povidone-iodine group and the antibiotic/steroid group. However, povidone-iodine was shown to decrease bacterial colonies by 91% when used preoperatively, reducing the risk of endophthalmitis after intraocular surgery by 75%, which has led to its acceptance as standard preoperative care.[7]

Evisceration and Enucleation Surgery

Unlike general, orthopedic, and plastic surgery, there is limited available data on the necessity of prophylactic antibiotics in eyelid and orbital surgeries, specifically periocular plastic surgeries. To address this gap, Fay et al.[8] examined the effectiveness of prophylactic antibiotics in preventing postoperative infections after enucleation and evisceration surgeries. These procedures were selected as representative models for periocular plastic surgeries in general due to their standardized nature and frequent utilization of alloplastic implants, which potentially increase the risk of postoperative infections. The authors reviewed the records of 644 patients who underwent enucleation or evisceration with alloplastic implants and divided them into two groups: those who received postoperative prophylactic antibiotics (n=381, 59%) and those who did not (n=263, 41%). The antibiotic group included 404 enucleations with implant cases, 31 enucleations without implant cases, 174 eviscerations with implant cases, and 35 eviscerations without implant cases. The patients in the study were prescribed different antibiotics, with the most common ones being cephalexin, clindamycin, or fluoroquinolone. However, there were instances where amoxicillin-clavulanate, trimethoprim-sulfamethoxazole, or amoxicillin were also used. Two patients showed signs of infection, one in the group that received antibiotics and one in the group that did not. While patients with indications for infectious surgery were more likely to receive antibiotics, there was no statistically significant difference in infection rates based on antibiotic administration. Importantly, none of the patients with infectious indications who did not receive antibiotics developed a postoperative infection. These findings suggest that withholding postoperative prophylactic antibiotics in orbital surgery, even with alloplastic material, is clinically safe. However, it is important to note that these results may not be applicable to non-sterile surgeries such as sinonasal or nasolacrimal procedures.[8]

Orbital Fracture

Orbital fractures, ranking among the most frequent facial injuries, often necessitate surgical interventions and subsequent treatment due to their potential complications. Postoperative infections are a known risk following orbital fracture surgeries, but prophylactic antibiotics can significantly mitigate this likelihood. Despite the noted benefits, consensus remains elusive regarding the optimal duration of postoperative antibiotic administration. The documented range for antibiotic prophylaxis following facial fractures extends from a single dose to 7 or even 10 days postoperatively. It is important to consider that the use of antibiotics may invite certain risks, including allergic reactions, toxicity, adverse effects, drug interactions, and the escalation of bacterial resistance.[9]

A study by Chole and Yee[10] demonstrated a decrease in infectious complications in facial fractures from 42.2% to 8.9% through the administration of an antibiotic dose 1 hour preoperatively and 8 hours postoperatively.

Zix et al.[9] conducted a prospective, single-center, randomized, double-blind, placebo-controlled clinical trial to assess the efficacy of postoperative prophylaxis in preventing infections after orbital fracture surgeries. In their study, 62 patients suffering from orbital blow-out fractures were randomly divided into two groups. All patients were administered 1.2 g of intravenous amoxicillin/clavulanic acid every 8 hours, starting from the admission time until 24 hours postoperatively. Afterward, the first group received an oral dose of 625 mg amoxicillin/clavulanic acid every 8 hours for an additional 4 days, forming the 5-day group. The second group, known as the 1-day group, were given an oral placebo thrice daily. Follow-up was scheduled at 1, 2, 4, 6, and 12 weeks and 6 months postoperatively, with orbital region infection as the primary end point. The findings revealed no significant difference in the rate of wound infection between the two groups. This suggests that antibiotic prophylaxis extending beyond 24 hours postoperatively does not significantly contribute to the prevention of postoperative infection and infectious complications in patients with displaced orbital fractures.[9]

Habib et al.[11] performed a meta-analysis and systematic review to evaluate the effect of postoperative antibiotic prophylaxis on the incidence of SSI in patients undergoing surgery for maxillofacial fractures. This review included 7 randomized controlled trials and 6 cohort studies, representing a robust sample of 1,268 patients in the intervention group and 968 patients in the control group. The addition of postoperative antibiotic prophylaxis to a standard preoperative and/or perioperative antibiotic regimen showed no significant impact on the risk of SSI. This study does not support the routine use of postoperative antibiotic prophylaxis in patients with maxillofacial fractures.[11]

Blepharoplasty

Infectious complications following blepharoplasty can include both preseptal and orbital cellulitis. Similar to other SSIs, *Streptococcus* and *Staphylococcus* species, particularly *S. aureus*, have been identified as potential causative agents.[12]

In the outpatient setting, the overall incidence of postoperative infections associated with eyelid surgery remains low. In a retrospective study conducted by Carter et al.[13] including 1,861 patients who underwent blepharoplasty with or without laser resurfacing, only 5 individuals were found to have postoperative infections. Topical antibiotics were administered to most patients in the study, and cases of infection were successfully managed with postoperative topical antibiotic treatment.

Despite the low incidence of postoperative infections, it is noteworthy that there has been a rise in the utilization of prophylactic antibiotics. However, there is not enough evidence supporting the effectiveness of antibiotic prophylaxis in blepharoplasty procedures.

Cefazolin has been established as the preferred preoperative antibiotic for facial cosmetic surgery, with selection based on expected pathogens. Nevertheless, the use of antibiotic prophylaxis in blepharoplasty remains a subject of debate, and there remains no universally accepted standard of care, resulting in varying practices worldwide. Gonzalez-Castro and Lighthall[14] acknowledged the absence of compelling evidence to support routine antibiotic prophylaxis in blepharoplasty and advocated for further research in this area, while Carter et al.[13] concluded from their study that topical antibiotic prophylaxis alone was sufficient for blepharoplasty procedures.

At present, specific guidelines regarding antibiotic prophylaxis for blepharoplasty are lacking, necessitating individual judgment on the part of the surgeon. In cases where a measurable risk of SSI is present, the administration of a single dose of intravenous cefazolin or cefuroxime 1 hour before the procedure has shown effectiveness. However, for procedures with extremely low infection rates, the routine use of antibiotic prophylaxis may not provide significant benefits, and potential risks should be taken into account.[12]

In a study of 232 patients investigating whether systemic prophylactic antibiotics reduce SSI in elective lid surgery, 99 patients were given combined systemic and topical antibiotics, while 133 patients were given only topical antibiotics.[15] Three patients in the combined group and two patients in the topical antibiotic group needed additional treatment. This study suggests that routine systemic antibiotic prophylaxis is not necessary in these patients.[15]

Dacryocystorhinostomy

Data on SSI rates in external dacryocystorhinostomy (DCR) surgery are scarce. Therefore, the question of whether routine postoperative antibiotic prophylaxis is necessary in external DCR remains somewhat controversial, as there is limited literature available to provide clear recommendations on preferred practice.[16]

Sheth et al.[16] conducted a study to compare the efficacy of postoperative oral antibiotics versus a single intravenous perioperative bolus dose of antibiotic prophylaxis in preventing SSIs after external DCR. The study included 338 adult patients (aged 18 years or older) with primary acquired nasolacrimal duct obstruction who underwent external DCR. It is important to note that a minimum of 4 weeks of postoperative follow-up was required for inclusion. The patients were randomly divided into two groups. Group A received a single intravenous perioperative bolus dose of 1 g cefazolin (a first-generation cephalosporin) administered within 15 minutes before the surgical incision. On the other hand, Group B received postoperative oral antibiotic prophylaxis consisting of 500 mg cefalexin taken twice daily for 5 days. The final analysis included 155 patients in Group A and 156 patients in Group B because of some loss to follow-up. The main outcome assessment took place 4 weeks after the postoperative follow-up. None of the patients in Group A, who received the single perioperative intravenous bolus dose of antibiotic, showed any evidence of SSI. Only one patient in Group B, who received the 5-day postoperative oral antibiotic regimen, developed an SSI, which was successfully managed with medical treatment. The study findings suggest that, in the current clinical setting, the use of a single intravenous bolus dose of antibiotic is as effective as the more commonly used 5-day oral antibiotic regimen in preventing postoperative SSI in external DCR.[16]

In another retrospective study including 1020 eyes of 899 patients, external DCR was performed on 747 eyes and endonasal DCR was performed on 273 eyes. None of the patients received preoperative prophylactic systemic antibiotic therapy. Postoperative SSI was observed in 8 patients who underwent external DCR (0.8% of all patients, 1.1% of external DCR patients), whereas no SSI was observed in any endoscopic DCR patient. The 8 patients diagnosed with postoperative SSI were successfully treated with oral systemic antibiotic therapy. No statistically significant difference was observed between the external and endonasal DCR groups in terms of postoperative SSI development. The authors concluded that lacrimal surgery is safe without the routine administration of prophylactic systemic antibiotics.[17]

In a retrospective study conducted to investigate the effect of preoperative, perioperative, and postoperative antibiotic use on the risk of infection after endoscopic DCR, postoperative infection was observed in 22 (6.6%) of 331 patients.[18] There was no significant difference in postoperative infection rates among patients who did not have acute dacryocystitis preoperatively and received peri- and postoperative antibiotics. However, patients who received antibiotics within 2 weeks before surgery for acute dacryocystitis but did not receive peri- or postoperative antibiotics had a higher postoperative infection rate. This study suggests that antibiotics may be beneficial when there is recent or active dacryocystitis before surgery, but otherwise, routine antibiotic prophylaxis is not necessary in endoscopic DCR.[18]

Special Agents

Mitomycin C

Pterygium

The primary treatment for pterygium removal involves surgical excision paired with conjunctival autograft (CAG).[19] Various adjunctive treatments have been designed to minimize the risk of pterygium recurrence. Among these, the antineoplastic agent MMC (0.02%) is the most commonly utilized due to its safety profile. By interfering with cell proliferation, MMC effectively controls endothelial cell proliferation during pathophysiological angiogenesis. However, the precise effectiveness and safety of MMC remain uncertain.[20,21]

To elucidate the efficacy and safety of MMC, Taher et al.[20] conducted a systematic review and meta-analysis. Their study aimed to thoroughly evaluate the combinations of CAG with MMC and amniotic membrane transplantation (AMT) with or without MMC in comparison to surgical excision with CAG alone for the treatment of primary pterygium. Outcome measures included recurrence rates and adverse events. The study included a total of 557 participants who received CAG alone, 520 who received AMT, and 67 who received CAG + MMC. The patients' mean ages ranged from 37 to 63 years across all treatment arms. Statistically significant reductions in recurrence rates were observed in the subgroup analysis of patients treated with CAG + MMC. Furthermore, 0.02% MMC was associated with lower recurrence rates compared to 0.01% MMC. The study findings underscored the effectiveness of CAG + MMC over other tissue grafting techniques in pterygium treatment. A one-time topical application of 0.02% MMC during pterygium excision followed by CAG transplantation was found to reduce the pterygium recurrence rate to 1.4% without causing serious complications.[20]

In a retrospective study, Katircioğlu et al.[22] compared the techniques of AMT, CAG, and MMC combined with excision in the treatment of primary and recurrent pterygium. A total of 49 cases, including 30 primary and 19 recurrent pterygium, were included in the evaluation. The patients were divided into three groups: Group 1 underwent excision with CAG (n=25; 18 primary, 7 recurrent pterygium), Group 2 underwent AMT (n=16; 12 primary, 4 recurrent pterygium), and Group 3 received low-dose MMC (0.02%) with CAG (n=8; all recurrent pterygium). AMT and CAG were equally effective in preventing recurrence in primary pterygium, and the combination of MMC and CAG was found to be at least as effective as CAG and AMT in the treatment of recurrent pterygium. The authors emphasized that a combined technique with MMC would be better reserved for recurrent or resistant cases, while one of the other two procedures should be used for the treatment of primary cases.[22]

Interferon Alpha-2b

Conjunctival Melanoma

The primary treatment for conjunctival melanoma (CM) is surgical excision with wide margins and double freeze-thaw cryotherapy.[23,24] However, there remains a lack of consensus regarding a standard topical adjuvant therapy. Primary acquired melanosis (PAM) with atypia can evolve into CM, leading to local recurrence after removal and possible regional or systemic spread.[23] IFN alpha-2b is an immunomodulatory glycoprotein with a direct impact on tumor cells, potentially activating the host immune system to target the tumor. Given the rarity of the condition (0.24-0.8 cases/million people), it is challenging to assess the effectiveness of topical IFN alpha-2b after CM resection. Topical IFN alpha-2b may be an alternative for recurrence. This treatment has seen success as either a primary or adjunctive treatment for ocular surface squamous neoplasia, and has been used in isolated cases of conjunctival PAM with positive outcomes and good tolerance.[25]

In a retrospective study by Huerva et al.[25], two patients with CM (a 66-year-old man and a 68-year-old woman) were treated with surgical excision using the "no-touch technique" followed by topical IFN alpha-2b (1,000,000 UI/mL) applied 4 times daily for 12 weeks as the primary treatment. The results demonstrated that supplementary IFN alpha-2b may extend survival up to 6 years post-resection in stage T1 patients, regardless of margin involvement, which aligns with previous studies. The authors concluded that IFN alpha-2b can continue to be used as an adjunctive therapy after CM resection due to its overall tolerability and proven efficacy in preventing recurrence.[25]

Squamous Cell Carcinoma

Ocular surface giant squamous cell carcinoma (SCC) is an invasive malignant lesion that can occur on the conjunctiva and cornea. It exhibits diverse presentations from inter-epithelial neoplasia to full-fledged squamous carcinoma with metastatic potential.

Recent studies have demonstrated the efficacy of early surgical excision followed by IFN alpha-2b as a coadjuvant topical treatment for invasive giant SCC. In one case report, biopsies from various parts of the conjunctiva, cornea, and limbus after treatment showed no signs of cellular dysplasia, and the patient remained tumor-free for 24 months. Mild hyperemia was the sole adverse event and resolved post-treatment.[26]

Traditionally, the primary modality for treating ocular surface SCC has been surgical resection. However, it carries a recurrence rate of 25-53%.[26] The usage of topical or intralesional antineoplastic agents like MMC or IFN alpha-2b has gained traction in recent years.[26,27,28] Despite its widespread use, MMC has been associated with multiple side effects, including scleral thinning, corneal perforation, and squamous metaplasia.[26,28] In contrast, IFN alpha-2b offers a safer topical treatment with superior patient tolerability.[26] Intralesional IFN alpha-2b has shown promising results in managing primary lesions and recurrences, typically as standalone treatment. In certain instances, it is applied preoperatively to decrease tumor size.[26] Research has indicated that complete remission is achieved in 72% of giant tumors treated solely with IFN alpha-2b either topically or via intralesional administration, while the remaining 28% display a substantial reduction in size.[26,29]

5-fluorouracil

Squamous Cell Carcinoma

SCC is the most common malignant conjunctival tumor and is characterized by invasion of the conjunctival stroma. The standard treatment strategy involves extensive local excision, supplemental cryotherapy, and thorough histological evaluation of the surgical margins. Despite these measures, there is a high rate of recurrence, even when the primary excision margins are devoid of malignant cells.[30,31] Topical chemotherapeutics such as MMC and 5-FU, either as monotherapy or as an adjunct to surgical excision, have been found effective against conjunctival and corneal intraepithelial neoplasia.[30,31,32]

A recent study evaluated the efficacy of topical 5-FU applied after conjunctival and corneal mass biopsies. Ten patients diagnosed with SCC of the conjunctiva, cornea, or both were treated with 1% topical 5-FU (administered as pulse doses four times daily for 4 days at monthly intervals for six cycles) and followed up for an average of 14.53 months (range, 6-30 months). All tumors responded to the topical 1% 5-FU treatment, with most patients achieving tumor resolution after the initial treatment series and requiring no further 5-FU treatment after six cycles. One patient who previously underwent three excisions and two cycles of 0.02% MMC eye drops in a different ophthalmic department had early disease recurrence. However, the tumor resolved after administering six cycles of topical 5-FU at monthly intervals, and the patient remained recurrence-free for 12 months after the final treatment cycle. This study supports the effectiveness of topical 1% 5-FU in managing SCC with no observable side effects. However, retreatment becomes necessary if the lesion recurs, and excisional biopsy is recommended if treatment fails.[31]

Anophthalmic Contracted Socket

A contracted socket can be described as the consequence of orbital tissue shrinkage and shortening, leading to a reduction in orbital volume and fornix depth. This results in the incapacity to hold a prosthesis in place. The impact of this condition can be both functional and psychological, significantly affecting the patient's well-being. Irrespective of the specific method or graft employed for reconstruction, the primary goal is to establish a socket that can accommodate a prosthesis, thereby achieving a satisfactory cosmetic outcome. The key to successful postoperative outcomes in socket procedures is the prevention of scarring. Recurrent socket contraction is often seen due to surgical bed contracture, necessitating multiple surgical interventions.[33]

Kamal et al.[33] conducted a retrospective comparative case series study to assess the efficacy of 5-FU following anophthalmic contracted socket surgery. The study included 15 adult patients exhibiting signs of recurrent socket contraction following reconstructive surgery using a buccal mucosa graft. The patients were split into two groups, with 8 patients (Group A) receiving serial subconjunctival 5-FU, and 7 patients (Group B) serving as a control group. Notably, none of the patients had previously had an implant in the socket. All patients underwent socket reconstruction with a full-thickness buccal mucosal graft from the lower lip used to augment the surface area in a standard manner. Patients in Group A were administered subconjunctival injections of 10 mg 5-FU in the superior and inferior fornices on a weekly basis for a total of four injections. In contrast, patients in Group B were managed conservatively. After 5-FU treatment, substantial improvement in fornix depth and socket volume was observed in 7 out of 8 patients in Group A, allowing for the fitting of larger conformers and subsequently prostheses with pleasing cosmetic results. Thus, weekly 5-FU injections were proven to be highly effective in mitigating recurrent fibrosis and contraction when applied early after reconstructive surgery. However, the authors noted that further evaluation is necessary to assess the optimal dose for serial subconjunctival 5-FU injections and the long-term effects of this treatment.[33]

Amphotericin-B in Sino-orbital Fungal Infections

While infrequent, sino-orbital fungal infections can lead to considerable adverse health effects, even resulting in death. Fungal colonization or non-invasive infections in the paranasal sinuses are more common, arising from inhaling fungal spores. In those with robust immune systems, these conditions can be managed effectively, often leading to favorable outcomes. However, for individuals with compromised immune systems, these infections can become invasive, causing substantial tissue damage and potentially fatal outcomes. These infections often spread from the paranasal sinuses to the orbit, which can exacerbate the condition due to the direct connections to the intracranial space.[4,34,35]

Conventional treatment modalities encompass systemic antifungal treatment, extensive surgical removal of affected tissues through sinus surgery and potential orbital exenteration, and enhancing the patient's immune capabilities and metabolic condition when possible. However, several older studies reported promising outcomes with limited orbital debridement paired with localized irrigation with amphotericin B alongside systemic antifungal treatment.[36]

To assess the effectiveness of amphotericin B, a study was conducted on 7 consecutive patients diagnosed with sino-orbital fungal infections. As soon as the diagnosis was suspected or confirmed by biopsy, each patient was administered intravenous amphotericin B (25-50 mg/day). Certain surgical procedures were also performed. Firstly, necrotic tissue was cautiously removed until healthy tissue with sufficient blood supply was visible. Crucial orbital structures, such as the medial and lateral rectus muscles and the globe, were identified and preserved whenever feasible. Prior to wound closure, intraoperative irrigation of the orbit and sinuses with an amphotericin B solution was performed. Care was taken to observe the outflow of the amphotericin B solution within the orbit and sinuses to ensure accurate placement and prevent significant proptosis during irrigation. The wound was subsequently closed in layers. Postoperatively, patients were subjected to three to four daily irrigations with 3-4 mL of amphotericin B. The study outcomes showed that a treatment regimen consisting of surgical debridement, local amphotericin B irrigation, and systemic amphotericin B therapy was successful in managing sino-orbital fungal infection in these seven cases. Most patients who had excellent preoperative vision were able to maintain their visual acuity postoperatively. Thus, the authors concluded that conservative orbital debridement combined with local amphotericin B irrigation is an effective supplementary treatment strategy for managing sino-orbital fungal infections.[36]

Conclusion

The use of prophylactic antibiotics is crucial in reducing the risk of infection in certain extraocular surgical procedures, but their effectiveness may not be significant in other surgeries. Antibiotic prophylaxis may not be required for every extraocular surgery. Multicenter, comparative, controlled studies are needed regarding the effectiveness and efficiency of prophylactic antibiotic use. Agents such as MMC and IFN alpha-2b have demonstrated efficacy in reducing the recurrence of extraocular conditions and enhancing surgical results. However, studies involving larger patient populations are required to solidify these findings and aid in the development of standardized treatment protocols.

Declarations

Authorship Contributions

Concept: D.D.A., Y.A.K., Design: D.D.A., Y.A.K., Data Collection or Processing: D.D.A., Analysis or Interpretation: D.D.A., Literature Search: D.D.A., Writing: D.D.A.

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