Original Article

Comparative study of the disinfection effects of three types of conjunctiva sac irrigations

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Abstract

Purpose: The disinfection effectiveness of 5% anerdian Ⅲ, 0.016% gentamicin, and 0.5% tobramycin solutions in pre-surgical irrigation of conjunctival sac were compared.

Methods: A total of 295 cataract patients (302 eyes) who had undergone phacoemulsification aspiration combined with intraocular lens insertion (IOL) were recruited in this prospective study. Operative eyes were given 0.3% levofloxacin eye drops for 3 d and then were randomized into three treatment groups, anerdian (A), gentamicin (B) and tobramycin (C). The patients received conjunctival sac irrigation using the respective solutions at 10 min preoperatively. Conjunctival sac sampling was performed before and after irrigation and the samples were used for subsequent bacterial culture and swab tests. The positive rate was used as the main parameter.

Results: Positive rates of bacterial culture before conjunctival sac irrigation: the positive rate was 17.31% (18 eyes) in group A, 13.86% (14 eyes) in group B and 17.3% (14 eyes) in group C. Post irrigation, the positive rates in the three groups decreased to 5.76% (6 eyes), 5.94% (6 eyes) and 7.22% (7 eyes), respectively. The positive rates among the three groups did not differ. However, the positive rate in group A significantly differed before and after the irrigation (P<0.05). No toxic or allergic reactions were found in the ocular surface of any patient after the irrigation. (***Eye Science 2013; 28*:-**)

Conclusion: The disinfection effects of the three types of conjunctival sac irrigations did not differ.

Key words: Anerdian, conjunctival sac irrigation, bacterial culture

The human conjunctival sac normally contains pathogens or bacteria[1,2]. Conjunctival sac irrigation is therefore a vital measure for preventing postoperative ocular infection, especially for the patients undergoing cataract surgery. Some foreign studies reported that use of 5% Povidone-iodine (PVP-I) irrigation before surgery can effectively reduce the number of pathogens residing in conjunctival sac and greatly lower the incidence of endophthalmitis and postoperative infection[3,4]. In China, no unified standard has been set for conjunctival sac irrigation used before ocular operation. In this study, we utilized dif ferent types of irrigations (5% anerdian Ⅲ, 0.016% gentamicin, and 0.5% tobramycin dilutions) and compared their disinfection effectiveness.

Subjects and methods

Study subjects

A total of 295 patients (302 eyes) who had undergone phacoemulsification combined with IOL in our hospital between May and December 2010 were randomly recruited in this investigation. The subjects included 172 males (146 eyes) and 123 females (156 eyes), aged 66.85±12.01 years on average, as shown in Table 1. Prior to operation, no lacrimal passage obstruction, secretion, or infectious eye disease was noted in any participant. All patients were randomly divided into groups A (anerdian-treated), B (gentamycin-treated) and C (tobramycin-treated) after receiving 0.3% levofloxacin eye drops for 3 d.

Main reagents

Anerdian Ⅲ disinfectant (non-alcohol) was purchased from Linkwell Corporation (Shanghai, China); the main components were available iodine 0.45%–0.57% (w/v) and chlorhexidine acetate 0.09%–0.11% (w/v). Before use, the concentration was diluted to 5% using sterile water for injection. In group B, 0.016% gentamicin irrigation was prepared

DOI: 10.3969/j.issn.1000-4432.2013.01.000
Funding: This study was supported by Fund for Medical Sciences and of Guangdong Province (A2012413)
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Table 1 Demographic information for the study subjects

Group	Cases	Eyes	Gender		Ocular side		Ages($\bar{x}\pm s$)
			M	F	Right	Left	
Anerdian and group	104	104	67	37	44	60	67.83±11.94
Gentamicin group	101	101	55	46	53	48	66.48±12.45
Tobramycin group	90	97	50	40	60	37	66.23±10.95
Total	295	302	172	123	157	145	66.85±12.01

by mixing a portion of 40 000 units of gentamicin sulfate injection with 250 mL saline. In the group C, a 0.5% tobramycin dilution was prepared by tobramycin sulfate injection solution and PBS at a ratio of 1:200.

Methods

All patients were given 0.3% levofloxacin eye drops for 3 d, four times a day and received lacrimal passage irrigation and mydriasis, etc. At 10 min before operation, the patients received conjunctival sac surface anesthesia using 0.5% proparacaine eye drops, the visual field was sterilized using 5% anerdian Ⅲ, and the eyelids were opened with an eye speculum. The conjunctival sac was sampled using a piece of sterile cotton by gently rubbing the conjunctival sac fornix and the sample was immediately inoculated onto blood agar media. The patients in groups A, B, and C received conjunctival sac irrigation with 5% anerdian Ⅲ, 0.016% gentamicin, and 0.5% tobramycin dilutions, respectively. The irrigations were kept within the conjunctival sac for approximately 30 s and then washed with 10 ml PBS. A swab test was performed on the conjunctival sac, and the sample was incubated in an incubator at 37℃. Forty-eight h post incubation, the positive rate of bacterial culture was evaluated.

Main parameters

Positive rates of bacterial culture were used as the key parameters; others included the irritation of irrigated conjunctival sacs towards the surface structures of the operated eyes including corneal epithelial changes and conjunctival hyperemia post irrigation.

Statistical analysis

SPSS 17.0 statistical software was utilized for data analysis. A Chi-square test was used for rate comparison and α=0.05 was considered as the level of significance.

Results

Comparison of the positive rates of bacterial culture among the three groups

The positive rates of bacterial culture in all groups decreased following conjunctival sac irrigation. In group A, the positive rate of bacterial culture significantly declined after irrigation (χ^2=6.783, P<0.05), while the rates in groups B (χ^2=3.552, P>0.05) and C (χ^2=2.617, P>0.05) did not differ before and after conjunctival sac irrigation. The positive rates among the three groups did not differ both before (χ^2=0.542, P>0.05) and after conjunctival sac irrigation (χ^2=0.210, P>0.05), as shown in Table 2.

Table 2 Comparison of the positive rates of conjunctival cultures between three groups

Groups	Eyes	Positive rates of conjunctival cultures(%)		$\chi^2(P)$
		Pre-eyewash	Post-eyewash	
A	104	18(17.31)	6(5.76)	6.783(<0.05)
B	101	14(13.86)	6(5.94)	3.552(>0.05)
C	97	14(14.43)	7(7.22)	2.617(>0.05)
$\chi^2(P)$	–	0.542(>0.05)	0.210(>0.05)	–

Comparison of the influence of three types of irrigations on corneal epithelia, conjunctival epithelia, and tear film

No severely toxic or allergic reactions were noted in the corneas or conjunctiva during and after operation. Post irrigation, eight patients (four in group A and two in groups B and C) presented with aggravated bulbar conjunctival hyperemia. No statistical significance was found among the three groups (P>0.05). Intraoperatively, no conjunctival edema, eyelid edema, corneal epithelial edema, opacity, or defects was observed. No ocular discomfort was report-

ed post irrigation.

Discussion

Intraocular infection is the most serious complication of eye surgeries, especially for cataract surgery. Preventing the relative risk of endophthalmitis is of ultimate importance. A multi-center study conducted by European Society of Cataract and Refractive Surgeons (ESCRS)[5] revealed that the incidence of endophthalmitis remained at 0.05% despite oral or topical intake of antibiotics before cataract surgery. In addition, topical usage of levofloxacin eye drops at 1 h preoperatively failed to reduce the risk of endophthalmitis. At present, conjunctival sac irrigation using 5% PVP-I (containing alcohol or no alcohol) before surgery is widely recognized as efficacious and safe[3,4,6].

Cilla et al[7] assessed commonly used prophylaxis techniques for bacterial endophthalmitis following cataract surgery and reported that preoperative PVP-I preparation received an intermediate clinical recommendation (B, moderately important to clinical outcome). All other reported prophylactic interventions, including postoperative subconjunctival antibiotic injection, preoperative lash trimming, preoperative saline irrigation, preoperative topical antibiotics, and irrigation with antibiotic-containing solutions received the lowest clinical recommendation (C, possibly relevant but not definitely related to clinical outcome) based on weak and often conflicting evidence justifying their use. No prophylactic technique received the highest of three possible clinical recommendations (A, crucial to clinical outcome).

Chinese scholars[8] detected bacteria in conjunctival sac prior to operation, but no unified standard has been proposed for the preoperative use of conjunctival sac irrigations. Traditionally, gentamicin or tobramycin solution was used for conjunctival sac irrigation. However, recent in vivo research using animals[9,10] has indicated that aminoglycosides, especially gentamicin, are toxic to corneal endothelia and the retina. However, the exact dose-effect relationship for human eyes is still unclear. In the current study, we utilized gentamicin and tobramycin as controls for comparison with anerdian Ⅲ.

Anerdian Ⅲ (Linkwell Corporation, Shanghai, China) is a disinfectant designed for skin mucosa. It has been used in clinical practice since 1989 and is li sted among the One Hundred Programs in Recent Ten Years assessed by Ministry of Health in China[11]. Its main components are available iodine 0.45–0.57% (w/v), chlorhexidine acetate 0.09–0.11% (w/v), and no alcohol. It is used for mucosal and wound disinfection after 10 to 20 fold dilution. It is similar to PVP-I, which is a stable chemical complex of polyvinylpyrrolidone and elemental iodine (0.5–0.6% available iodine) and can effectively kill pathogens by releasing equivalent amounts of available iodine, which can induce protein denaturation and precipitation. It is a broad spectrum topical antiseptic for the treatment and prevention of infection in wounds and has an apparent and consistent effect, low toxicity, and no irritation at the site of application.

According to the underlying mechanisms, an iodine preparation is superior to antibiotics in terms of disinfection effects. However, iodine preparations are seldom applied in the conjunctival sac due to safety concerns. In China, a substantial number of studies have suggested that PVP-I has relatively good disinfection effect[12-14]. Anerdian contains similar components to PVP-I and our test of anerdian in preoperative conjunctival sac irrigation revealed no toxic reactions. This investigation revealed no adverse events except for four cases presenting with aggravated bulbar conjunctival hyperemia after irrigation. Previous animal studies[15] found that 10% PVP-I caused rabbit corneal epithelial edema 5 min after usage but no severe ocular surface changes were observed after 3 h, suggesting that 10% PVP-I has no toxicity towards rabbit corneas. Pels et al[16] soaked donated eyeballs and corneas in various concentrations of PVP-I and concluded that soaking in 5% PVP-I for 2 min can effectively reduce the number of microorganisms compared with other concentrations and soaking times. In addition, PVP-I was blocked outside the corneal layers and showed low toxicity. Other studies recommended keeping PVP-I irrigation solution within conjunctival sac for at least 30 s[17].

In this study, no statistically significant differences were found among the three groups for the positive rates of bacterial culture, suggesting that the disinfection effects of these three irrigations do not

differ. The positive rate of bacterial culture in group A significantly decreased following anerdian irrigation, while no statistical significance was noted in the other groups. Therefore, 5% anerdian III dilution is safe and effective for the preoperative disinfection of the conjunctival sac. The positive rate of bacterial culture seen prior to irrigation was 14~18%, which is slightly lower than 20~40% reported by foreign scholars[3,4]. However, no agreement has been reached regarding the disinfection effect of antibiotics considering multiple influential factors.

The widespread application of antibiotics raises concerns about the bacterial drug resistance. Thus, the use of disinfectants in the prevention of intraocular infection is a safe and viable alternative. This clinical trial suggested that a 5% anerdian Ⅲ dilution can effectively reduce the relative risk of postoperative ocular infection.

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