ORIGINAL ARTICLE

Post-traumatic endophthalmitis prophylaxis with oral ciprofloxacin in comparison to intravenous cephazolin/gentamicin

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Background: Although posttraumatic endophthalmitis is an uncommon condition, it causes severe complications, so medical and pharmacological interventions for prevention of endophthalmitis after trauma are a major concern. The aim of this study was to evaluate the efficacy and clinical outcome of oral ciprofloxacin versus intravenous cefazolin/gentamicin for the prevention of endophthalmitis after penetrating ocular trauma. **Materials and Methods:** This was a retrospective, descriptive single-center study, including all cases of penetrating ocular trauma seen in the Feiz Hospital, a Tertiary Referral Eye Hospital in Isfahan, Iran, between 2011 and 2017. Data systemically recorded for each patient included clinical, ophthalmological, and demographic findings by a trained medical record abstractor or ophthalmologist reviewing patient records. **Results:** Six hundred and forty-five patients in cefazolin/gentamicin and 273 patients in oral ciprofloxacin groups were included in the study. Our study showed that the incidence of endophthalmitis was not significantly different between the two groups ($P = 0.463$). In patients with either sharp or blunt penetrating ocular trauma. **Conclusion:** Oral ciprofloxacin as a prophylactic treatment could prevent posttraumatic endophthalmitis as effective as injectable cefazolin/gentamicin. Due to easier consumption of oral ciprofloxacin and lower systemic complications, in all patients with penetrating eye trauma, oral administration of ciprofloxacin is preferable to intravenous or intramuscular types of antibiotics to reduce the risk of posttraumatic endophthalmitis.

Key words: Cefazolin, ciprofloxacin, endophthalmitis, gentamicin, penetrating ocular trauma

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INTRODUCTION

Endophthalmitis is a critical complication associated any ocular procedure or trauma. Serious complications including decreasing visual acuity (VA) and permanent loss of vision may happen after endophthalmitis, so prophylaxis is a major concern.[1,2]

Postoperative endophthalmitis has been reduced since 1980 due to modern surgery, instrumentation, sterility, and prophylactic antibiotics;[3] however, surgery (such as cataract surgery) remains the most common exogenous sources of endophthalmitis.[4] Posttraumatic endophthalmitis is uncommon that only 3.4% of patients with penetrating ocular injuries are suffering from endophthalmitis in the United States.[5,6] Risk factors have been reported for developing posttraumatic endophthalmitis including older ages,[1,7] delay primary repairing of the globe wound (>24 h), lens capsule rupture, dirty wound,[7] remaining of intraocular foreign body (IOFB), crystalline lens involvement, and vitreous prolapsed.[8] Serious complications may happen after endophthalmitis including decreasing VA and permanent loss of vision that may require enucleation of the eye and even sometimes mortality of the patient, especially in endogenous sources cases.[9]

Although there are different approaches for the use of antimicrobial agent for endophthalmitis

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prophylaxis,[10,11] there is no evidence-based guideline for the use of special type of antibiotics in the prevention of endophthalmitis.[12] Moreover, recent studies have shown that there is no difference between oral and intravenous antibiotics in the prevention of endophthalmitis.[12,13] Recent studies showed the acceptable effect of ciprofloxacin and ceftazidime on preventing bacterial endophthalmitis.[6]

The aim of this study was to evaluate the efficacy and clinical outcome of oral ciprofloxacin and injectable cefazolin/gentamicin for the prevention of endophthalmitis after penetrating ocular trauma. In addition, we evaluate other associated factors for increasing risk of posttraumatic endophthalmitis.

MATERIALS AND METHODS

Study design and participants

This is a retrospective, observational single-center study conducted in Feiz Hospital, a tertiary referral eye hospital in Isfahan, Iran, between 2011 and 2017. The Medical Ethics Committee of Isfahan University of Medical Sciences reviewed and approved the research (ir.mui.rec. 1396.3.800).

The diagnosis of penetrating ocular trauma in this study was defined by the international statistical classification of diseases and related health problems, 10th revision codes.[14] The diagnosis of endophthalmitis defined as any deterioration in the clinical signs such as hypopyon, reduction in the VA, Marcus-Gunn, or positive microbial culture.

The inclusion criteria consisted of all patients with penetrating ocular trauma (with either a sharp trauma or blunt trauma), age >18 years and availability to patients' records. Other inclusion criteria were lack of underlying ocular disease or surgery, absence of underlying systemically disease. The exclusion criteria consisted of deficiencies in the essential information, patients who developed BUN/Cr rise during treatment with cefazolin and gentamicin, incomplete treatment and withdraw the treatment.

Antimicrobial agent for endophthalmitis prophylaxis had been initiated in the emergency room (oral ciprofloxacin 500 mg every 12 h for 3 days, cefazolin 50 mg/kg/day divided into four doses, and gentamicin 1 mg/kg/day divided into three doses).

A trained medical record abstractor or ophthalmologist evaluated the medical records including hospital charts, clinical and surgical notes, laboratory, and radiological studies.

The collected data in chart review were as follows: age, gender, slit-lamp examination of injury, type of trauma (sharp vs. blunt), source of injury (metal, wood, and stone), site of penetrating trauma (cornea, sclera, and cornea-sclera), presence of IOFB, VA at admission, medical imaging of orbit, time between trauma to repair (>24 vs. <24 h pass), type of posttraumatic endophthalmitis prophylaxis (oral ciprofloxacin vs. injectable cefazolin/gentamicin), and patient's outcome.

Statistical analysis

Statistical analysis of data was performed using IBM SPSS Statistics version 25. We used Chi-square and independent *t*-test to compare quantitative and categorical data between two groups, respectively. We used Mann–Whitney U-test for ordinal variables. We investigated the relationship between types of prophylaxis treatment with endophthalmitis incidence using regression logistic. $P < 0.05$ was considered as statistically significant.

RESULTS

Finally, after reviewing all charts 918 patients with penetrating ocular trauma were included in the study (645 patients in the injectable group and 273 in the oral group); total sample was included 793 (86.4%) men and 125 (13.6%) women with mean age 35.35 ± 15.81 years (18–90 years) that among them 23 patients with the diagnosis of endophthalmitis were hospitalized. There were 160 patients (17.4%) with an IOFB. Significant differences were observed between groups in terms of age ($P < 0.001$), site of trauma ($P < 0.001$), object causing trauma ($P < 0.05$), and time pass between trauma to repair ($P < 0.001$) [Table 1].

The association between types of treatment with endophthalmitis risk in the presence of confounding variables was evaluated using logistic regression. There was no significant difference between two treatments in terms of risk of endophthalmitis (odds ratio [OR]: 0.433, confidence interval [CI]: 0.046–4.032). Moreover, endophthalmitis risk was not statistically associated with ($P > 0.05$) objects causing trauma (metal and stone, wood, and other), admission VA, age, sex, site of trauma (cornea, sclera, and cornea-sclera), and time pass from injury to repair. Increasing risk of endophthalmitis was significant with the presence of IOFB (OR: 3.984, 95% CI: 1.225–12.820) [Table 2].

Considering that none of the patients with blunt trauma had developed endophthalmitis, we did subgroup analysis in patients with sharp trauma; the results have been presented in Table 3. The observed results in this subgroup were similar as total sample.

DISCUSSION

The result of our study demonstrated that there is no significant difference in the risk of endophthalmitis by administration of oral ciprofloxacin versus intravenous

Table 1: Basic and clinical characteristics of study patients in two groups

Variables	Oral ciprofloxacin (*n*=273), *n* (%)	Injectable cefazolin/ gentamicin (*n*=645), *n* (%)	*P**
Age	38.6±15.96	33.97±15.56	<0.001
Sex			
Male	245 (89.7)	548 (85)	0.053
Female	28 (10.3)	97 (15)	
Site of trauma			
Cornea	161 (59)	241 (37.4)	<0.001
Sclera	69 (25.3)	191 (29.6)	
Cornea-sclera	43 (15.8)	213 (33)	
Object causing trauma			
Metal	109 (43.8)	253 (39.2)	0.018
Wood	28 (11.2)	44 (6.8)	
Stone	17 (6.8)	30 (4.7)	
Other	95 (38.1)	318 (49.3)	
IOFB			
Yes	56 (20.5)	104 (16.1)	0.109
No	217 (79.5)	541 (83.9)	
Endophthalmitis			
Yes	10 (3.7)	13 (2.0)	0.144
No	263 (96.3)	632 (98.0)	
Time pass between trauma to repair (>24 h, <24 h)	1.50±0.51	1.18±0.38	<0.001

*Resulted from independent *t*-test or Chi-square test. IOFB=Intraocular foreign body

Table 2: Odds ratio and 95% confidence interval for odds ratio of the logistic regression of the association between treatment types in the presence of confounding variables

	OR	%95 CI		*P*
		Lower	Upper	
Different antibiotic treatment (cefazolin/gentamicin) (1)	0.433	0.046	4.032	0.463
Age	0.995	0.955	1.037	0.822
Sex (male) (1)	1.510	0.175	12.987	0.707
Location of injury				
Cornea-sclera (1)				0.577
Cornea	0.726	0.167	3.144	0.670
Sclera	1.474	0.359	6.060	0.589
Material causing trauma				
Metal	3.174	0.625	16.129	0.163
Wood	4.310	0.562	33.333	0.159
Stone	3.731	0.312	45.454	0.298
Other (1)				0.474
IOFB (presence of IOFB) (1)*	3.984	1.225	12.820	0.021
VA**	0.873	0.712	1.070	0.193
Time pass between trauma to repair (<24 h) (1)	0.791	0.205	3.048	0.734

(1) Reference variable is ciprofloxacin treatment, female, cornea-sclera, other cause of trauma, absence of IOFB, time pass to repair >24 h. *Intraocular foreign body, **VA. IOFB=Intraocular foreign body; VA=Visual acuity; CI=Confidence interval; OR: Odds ratio

cefazolin/gentamicin so that oral ciprofloxacin can be a recommended for posttraumatic endophthalmitis.

The results of the current study compatible with the study of Tabatabaei *et al*. reported that there is no statistically significant difference in the occurrence of postoperative endophthalmitis after operation among patients with penetrating ocular trauma with either sharp or blunt trauma, receiving intravenous or oral systemic antibiotics as an endophthalmitis prophylactic management.[12] In their study, 1.8% received intravenous antibiotics and 1.3% received oral antibiotics developed endophthalmitis 3 days after surgery that was not statistically significant differences, while at the end of week 1, 2 (0.3%), and 5 (0.8%), more patients who received intravenous and oral antibiotics, respectively, developed endophthalmitis which was not statistically significant.

The result of randomized controlled trial by Du Toit N *et al*. demonstrated that difference was not statistically significant for the development of endophthalmitis after open globe injury between patients receiving intravenous and oral antibiotics as an endophthalmitis prophylaxis.[13]

Therefore, it seems that the use of oral antibiotics alone can prevent posttraumatic endophthalmitis as efficient as intravenous antibiotics. A broad spectrum of microbes causes posttraumatic endophthalmitis including Gram-positive cocci, Bacillus species, fungi, and mixed infections. Coagulase-negative staphylococcal infection was statistically associated with delayed repair and metallic injury. Variation in antibiotic susceptibility observed among isolated bacteria and between different periods.[6]

Long *et al*. reported that ciprofloxacin and ceftazidime had a good efficacy in reduction of posttraumatic endophthalmitis in their retrospective study.[6] Moreover, they recommended that for infections caused by *Pseudomonas aeruginosa*, a combination therapy of ciprofloxacin, tobramycin, and one of the cephalosporins have optimal coverage.[6]

Benz *et al*. reported that all cases of their study with endophthalmitis were sensitive to ceftazidime, ciprofloxacin, and aminoglycoside but were resistant to vancomycin, so they recommended that ciprofloxacin could be used as an alternative treatment for endophthalmitis compare with parenteral antibiotics.[15]

Katibeh *et al*. evaluated the efficacy of various antibiotics for endophthalmitis prophylaxis and demonstrated that only 28% of patients received ciprofloxacin to prevent endophthalmitis.[16]

The limitations of the current study were retrospective nature of the study, relatively short follow-up, and lack

Table 3: Odds ratio and 95% confidence interval for odds ratio of the logistic regression of the association between treatment types in the presence of confounding variables in sharp trauma subgroup

	OR	95% CI		*P*
		Lower	Upper	
Different antibiotic treatment (cefazolin/gentamicin) (1)	0.449	0.048	4.149	0.481
Age	0.996	0.956	1.038	0.857
Sex (male) (1)	1.383	0.162	11.764	0.767
Cornea-sclera (1)				0.543
Cornea	0.717	0.165	3.115	0.657
Sclera	1.510	0.367	6.211	0.568
Metal	2.173	0.442	10.638	0.339
Wood	2.873	0.375	22.222	0.309
Stone	2.518	0.212	30.303	0.464
Other (1)				0.740
IOFB (presence of IOFB) (1)*	3.831	1.194	12.345	0.024
VA**	0.869	0.708	1.067	0.181
Time pass between trauma to repair (<24 h) (1)	0.702	0.180	2.739	0.611

(1) Reference variables are ciprofloxacin treatment, female, cornea-sclera, other cause of trauma, absence of IOFB, time pass to repair>24 h. *Intraocular foreign body, **VA. IOFB=Intraocular foreign body; VA=Visual acuity; CI=Confidence interval; OR: Odds ratio

of controlling of confounding variables. Although our study had some limitation, the strengths of our study were providing more information about the efficacy of ciprofloxacin as an effective medication with easier consumption compared to the injectable antibiotic in the prevention of endophthalmitis after eye penetrating trauma.

CONCLUSION

The result of our study demonstrated that there is no significant difference in the risk of endophthalmitis by administration of oral ciprofloxacin versus intravenous cefazolin/gentamicin so that oral ciprofloxacin can be a recommended for posttraumatic endophthalmitis. Further randomized clinical trial with larger sample sizes and longer follow-ups is warranted to evaluate the efficacy and safety of ciprofloxacin in endophthalmitis prophylaxis in different populations.

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Conflicts of interest

There are no conflicts of interest.

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