Evaluation of Positive Culture during the Initial Healing of Penetrating Ocular Trauma

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Abstract: Endophthalmitis is usually a devastating complication, followed by penetrating eye injuries that often causes severe loss of vision. Bacterial and fungal cultures were used to evaluate the primary healing of penetrating ocular trauma which is positive in the diagnosis of endophthalmitis. **Materials and Methods:** This prospective study was performed on 105 patients with penetrating eye trauma during the initial healing, in which, bacterial and fungal cultures were obtained from wounds, vitreous, aqueous humor and intraocular foreign body. The positive culture rate of endophthalmitis was compared in eyes with and without clinical diagnoses. In addition, factors affecting in causing positive culture and endophthalmitis was studied. **Results.** About 24% of patients had positive culture of wound, vitreous, aqueous humor and the intraocular foreign body. Thirteen percent (13%) of clinically diagnosed endophthalmitis were developed during treatment. 50% of patients enjoyed positive culture with clinical diagnosis of endophthalmitis. Despite positive cultures, 18 eyes (20%) had not any sign of endophthalmitis. Sclera rupture was observed in 25 patients with 48% positive culture and also in 20 patients with 25% negative culture. 32% of 25 patients with the positive culture enjoyed iris prolapse and 80 patients with 11% negative culture enjoyed iris involvement. Patients with 40% positive culture and also patients with 10% negative culture had a foreign body in the eye. Of 14 cases of positive culture of pathogenic organisms, 43% faced endophthalmitis. **Discussion.** Despite the positive bacterial cultures during primary healing of penetrating ocular trauma, clinical infection is not created. So, bacterial culture during the initial healing is not helpful in diagnosis of the next endophthalmitis. Iris involvement, sclera laceration and intraocular foreign body increases possibility of positive bacterial cultures during the initial healing significantly. Possibility of risk of endophthalmitis is increased in case of entrance of microorganisms with more virulence during penetrating ocular trauma to the eye.

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1. Introduction

Endophthalmitis is usually a devastating complication following penetrating ocular injuries. Endophthalmitis often causes severe vision loss or eye. (3-1), Endophthalmitis is caused by a unique spectrum of microorganisms following penetrating ocular injuries. Despite the use of antibiotics within the eye (intraocular), it is associated with poor prognosis. (4) The accurate diagnosis in the early stages may delay due to the initial inflammation of the wound. The initial rapid wound healing with the use of intravenous broad-spectrum antibiotics, the rapid diagnosis of endophthalmitis and related organism along with on-time treatment is the only way to improve prognosis. (8-5) Prolapsed tissue culture, intraocular foreign body sometimes helps early detection of clinical diagnosis and treatment of endophthalmitis during penetrating ocular injuries.

Some surgeons recommend that culture should be conducted normally from edge in corneal injuries and corneal edge-sclera (Corneal or coneo – sclera laceration) and also intraocular foreign body and vitreous. (9) Given the relatively high prevalence of edophthalmitis after trauma and to evaluate the impact of bacterial culture on the treatment of patients with penetrating ocular trauma at the time of primary repair, we see it as a prospective study in a specialized ophthalmology hospital (Sajad Hospital, Yasuj).

2. Materials and Methods

This prospective study was conducted on eye patients to evaluate the incidence of positive culture and its related factors during the initial repair. All patients with ocular trauma stood at 624, regarded as subject of study, who had been hospitalized and underwent primary surgical operation as of the beginning of Farvardin 1386 (April 2007) up to the end of Esfand 1388 (March 2010) in Sajad Hospital, Specialized Eye ward, Yasuj**.**

The sample population stood at 105 patients and culture was performed from their eyes during the initial healing. The subject of study was explained for eligible patients and they were fully satisfied and

informed consciously. The following information was asked from each patient before surgery: age, gender, lesion in the eye, cornea – scleral, lens involvement, Iris prolapse, existence of foreign object in the eye, location of injury (city and village), time to create lesion up to the initial healing, signs and symptoms of endophthalmitis, etc. The following information was asked from each patient during surgery: symptom of infection, use of intraocular antibiotics, and place of culture (external, anterior chamber, vitreous, intraocular foreign body (IOFB).

External culture was performed from conjunctiva, edge of wound or prolapsed tissues. The information after the surgery included: result of culture, clinical course of disease and extent of endophthalmitis. Broad-spectrum intravenous antibiotics were prescribed for all patients before and after surgery. Foreign culture of wound and prolapsed tissues started during surgical operation. After draping and prepping, 0.1cc of aqueous humor was sampled by TB syringe due to the place of lesion in case of involvement of cornea and anterior chamber of eye.

In case of involvement of scleral and prolapse of vitreous and/or when there was not the possibility of sampling from aqueous humor, 0.2cc of vitreous was sampled and blood agar, chocolate agar and sabourauds, Thioglycolate agar should have been sent to the laboratory immediately. After 48 to 72 hours of study time, the result was recorded in case of growth of microorganism. Culture was done from intraocular foreign object in 14 cases as well. Intraocular antibiotic was injected if doubted to endophthalmitis.

All patients received intravenous antibiotics during their hospitalization in hospital. (From 3 to 10 days: average 3.5 days). Diagnosis of endophthalmitis was performed based on infectious clinical symptoms and positive cultures. Endophthalmitis clinical signs included Hypopyon, severe vitrite, infectious secretions from the wound, corneal ring infiltration.

The results of culture were studied based on place of lesion in eye, time to create lesion up to the primary repair of injury, location of injury, lens involvement, involvement of iris and microbe virulence. A comparison was made between the eyes with endophthalmitis-infected patients and non-infected patients. All the information, obtained from 105 patients, was entered into the computer. Statistical analysis was performed by using SPSS program. Logistic Regression statistical test was used to determine chance of each variable in creation of positive culture while Fisher Exact Test was used to study relationship of variables in creation of endophthalmitis.

3. Results

Of total 105 patients, 87 of them were men (82.9%) while 18 of them were female (17.1%). The age of patients stood at between 2 to 80 years old (average 24.5 years old). Of total 105 patients, 141 culture samples were obtained. Based on clinical symptoms, endophthalmitis was developed in 14 patients (13.3%). Of total 105 patients, 25 of them (23.8%) had positive culture which includes 7 patients (50%) of 14 patients with endophthalmitis and 18 patients (19.7%) from 91 patients without endophthalmitis. In this study, patients received intravenous antibiotics for prophylaxis of infection.
But only those patients, who had clinical evidence of endophthalmitis, received intraocular antibiotics. (Table 1) Eight patients (32%) with the positive culture had referred before 24 hours while 17 patients (68%) had referred after 24 hours, but among 80 patients with the negative culture, 31 patients (38.7%) and 49 patients (61.3%) had referred before and after 24 hours respectively. ($p>0.05$) With regard to the positive culture, 17 patients (68%) and eight patients (32%) were living in village and city respectively. With regard to the negative culture, 47 patients (58.8%) and 32 patients (41.2%) were living in village and city respectively($p>0.05$). 13 patients (52%), with the positive culture, had cornea rupture and 12 patients (48%) had cornea rupture and sclera or sclera ONLY. 60 (75%) patients with the negative culture had cornea rupture and 20 patients (25%) had cornea rupture and sclera or sclera ONLY. ($p=0.29$).

Patients with the positive culture stood at 8 (32%) having iris prolapse and 17 patients (68%) had not any iris involvement ($p=0.26$). Nine patients (11%) with the negative culture had iris involvement and 71 patients (89%) with the same condition did not have any iris involvement. Six patients (24%) with the positive culture had lens involvement and 19 patients (76%) did not have any lens involvement. ($p=0.94$)

20 patients (25%) with the negative culture had not any lens involvement and 60 patients (75%) had lens involvement. 10 patients (40%) with the positive culture were found with foreign body in their eyes and 15 patients (60%) had not foreign body in their eyes (Table 1). Eight patients (10%) with the negative culture had foreign object in their eyes and 72 patients (90%) had not foreign object in their eyes ($p= 0.001$) .Of total 141 cultured samples, 26 cultures were taken from vitreous, 15 from intraocular foreign body, 40 from wound and 60 from anterior chamber. The frequency of positive culture samples had been in the form of vitreous (8 to 30.7%), intraocular foreign body from 5 to 33%, wound from 10 to 25% and anterior chamber from 5 to 83%. (Table 2)

Table 1. Comparison of risk factors in patients with positive and negative culture				
Description		Positive Culture	Negative Culture	Significant
Number(Percent)		25(23.8%)	80(76.2%)	
Sex	Female	20%	16.2%	P=0.762
	Male	80%	83.8%	
Age(Year)	<11	20%	21%	P= 0.91
	11-20	28%	31%	
	21- 30	24%	22%	
	31- 40	12%	13%	
	>40	16%	13%	
Delay in referring	<24 Hours	32%	38%	P=0.639
	>24 Hours	68%	62%	
Location	Urban	32%	41%	P=0.485
	Rural	68%	59%	
Tear in the eye area	Corneal	52%	75%	P=0.029
	Corneo & or Sclera	48%	25%	
Conflict lens	Has	24%	25%	P= 0.91
	Not has	76%	75%	
Tear of iris	Has	32%	11%	P= 0.026
	Not has	68%	89%	
Foreign object in the eye	There is	40%	10%	P=0.001
	There is not	60%	90%	

Table 2. Culture results based on cultivation cultured place						
Cultured place	Cultured number	Positive number	Endofetalmit number	Sensitivity	Specificity	True Diagnose power
Wound	40	10	6	%33	76%	70%
Anterior chamber	60	5	5	60%	90%	88%
Vytrvs	26	8	7	71%	94%	88%
Foreign object in eye	15	4	4	50%	77%	73%

Effect of culture is shown in Table 2 in accurate diagnosis of eyes with clinical infection due to the location of culture. The culture of wound has the lowest sensitivity (33%) but enjoys average power (70%) (p=0.059). Vitreous culture enjoys average sensitivity (71%) and also enjoys average-to-high diagnosis effect (88%) (P=0.048). Culture from intraocular foreign body enjoys low sensitivity and average diagnosis effect (p=0.035) .The low number of anterior chamber culture in eyes with endophthalmitis limits our ability to determine diagnosis of anterior chamber cultures.Positive cultures were classified into two pathogenic and non-pathogenic groups. Negative Coagulase staphylococcus and propyono bacterium acne is considered in non-virulence group while other organisms and mixed cultures are considered as virulence organisms. The clinical data of patients with the positive culture is shown in Table 3. Coagulase staphylococcus had been the most common organism in 10 to 40% of 25 patients. Bacillus (isolated from three patients (43%) had been the most common organism in the eyes with the clinical evidence of infection. Of total 14 patients with endophthalmitis, seven of them (50%) were found with the positive culture while seven of them were found with the negative culture as well. (p=0.037) But from 91 patients without endophthalmitis, 18 patients (19.7%) were found with the positive culture. (Table 3) With due observance to the classicization of organisms to Group 1: with virulence and Group 2: without virulence, of total 14 cases with the positive cultures in Group 1, 6 of which (42.8%) faced endophthalmitis subsequently. (p=0.027) Of total 11 cases with the positive culture in the Group 2, only once case faced endophthalmitis. *(Table 3)*

Intraocular foreign body was found in four cases (28%) endophthalmitis. (p=0.622) Of 91 patients without endophthalmitis, 12 cases (15.3%) were found with intraocular foreign body. 12 patients (86%) had referred with the clinical diagnosis of endophthalmitis after 24 hours while in endophthalmitis-free group, 49 patients (54%) had referred after 24 hours (p=0.047). The lens involvement in endophthalmitis-free patients stood at 43% versus 22%. *(p=0.092)* (Table 4)

Table 3. Clinical information of patients with positive culture					
Row	Clinical Infection	Time(Hours)	Organism	antibiotic intraocular injection	Foreign object in eye
1	No	<24	Staphylococcus aureus	No	Yes
2	No	>24	Staphylococcus aureus	No	Yes
3	No	<24	Streptococcus	No	Yes
4	No	<24	Staphylococcus	No	No
5	No	<24	Coagulase-negative staphylococcus	No	Yes
6	No	<24	Mixed organism	No	Yes
7	No	>24	Staphylococcus epidermis	No	No
8	No	>24	Staphylococcus epidermis	No	No
9	No	>24	Staphylococcus epidermis	No	No
10	No	>24	Streptococcus pneumoniae	No	No
11	No	<24	Staphylococcus epidermis	No	Yes
12	Yes	>24	Staphylococcus aureus	Yes	No
13	No	>24	Coagulase-negative staphylococcus	No	No
14	No	<24	Bacillus species	No	Yes
15	No	<24	Bacillus species	No	No
16	No	>24	Staphylococcus epidermis	No	Yes
17	No	>24	Coagulase- negative stphylococcus	No	No
18	Yes	>24	Pseudomonas species	Yes	No
19	No	<24	Coagulase- negative stphylococcus	No	No
20	Yes	>24	Bacillus subtilis	Yes	No
21	Yes	>24	Bacillus species	Yes	No
22	Yes	>24	Bacillus species	Yes	Yes
23	Yes	>24	Coagulase- negative stphylococcus	Yes	No
24	No	>24	Streptococcus pneumoniae	No	No
25	Yes	>24	Bacillus species	Yes	Yes

Table 4. Comparison of risk factors in two groups; With and without endophthalmitis.				
Description		With endophthalmitis	Without endophthalmitis	Sig.
Sex	Female	3(22%)	15(17%)	P= 0.704
	Male	11(78%)	76(83%)	
	Total	14(13%)	91(87%)	
Delay to referring	<24	2(14%)	42(46%)	P= 0.047
	>24	12(86%)	49(54%)	
Location	Urban	4(28%)	37(41%)	P=0.558
	Rural	10(72%)	54(59%)	
Tear place in eye	Cornea	8(57%)	65(71%)	P=0.351
	Corneal or coneo – sclera	6(43%)	26(29%)	
Lens involving	Has	6(43%)	20(22%)	P=0.092
	Not has	8(57%)	71(78%)	
Prolaps	Has	4(29%)	13(14%)	P=0.236
	Not has	10(71%)	78(86%)	
Foreign object in eye	There is	4(29%)	14(15%)	P=0.622
	There is not	10(71%)	77(85%)	

4. Discussion

In this prospective study, bacterial and fungal culture was obtained from wound, vitreous, aqueous humor and intraocular foreign body among 105 patients with penetrating ocular trauma, showing 23.8% (25 out of 105 patients) positive culture. Seven patients (5%) out of 14, having endophthalmitis, proved with the positive culture while other 91 patients, despite positive culture, did not have any sign of endophthalmitis from 18 eyes (19.7%). This study showed that although rate of endophthalmitis is increased as a result of positive culture, (p=0.037), positive culture is observed in absence of clinical endophthalmitis in penetrating eye trauma as well. Although vitreous positive culture can be followed with high risk of endophthalmitis, it is occurred without causing clinical infection as well. Probably, these results can show high rate of entrance of bacteria or sub clinical infection of eye injuries while causing lesions despite high rate of entrance of bacteria into the eye. It is possible that host's natural defense prevents from causing clinical infections in most patients despite high levels of entrance of bacteria into the eye at the time of trauma, details of which have been shown in the previous studies as well (10). The previous studies show high rate of positive culture after cataract surgery despite low incidence of clinical infection (11). Since each patient receives is receiving prophylactic systematic antibiotics, perhaps, a useful role can be guessed for the systematic antibiotics as reduction of positive culture rate has been shown from the anterior chamber during the initial repair in patients treated by topical antibiotic before surgery. *(Ariyasy RG) (12)* Although intravenous antibiotics may reduce clinical infection, the present study cannot answer the question about the use of prophylaxis systematic antibiotics. In this study (Dannenberg A), any significant relationship was not found between the positive culture and delay more than 24 hours up to the initial healing. (p=0.774) although the previous studies have linked the incidence of endophthalmitis with the delay more than 24 hours. (13). In this study, frequency of positive culture did not correlate significantly in the village and city but (Thompson and Boldt HC) have shown that incidence of endophthalmitis is high due to the high virulence of the microbes in rural environments. (Bacillus Cereus) (3, 14). In this study, it was shown that iris prolapse can increase the risk of positive cultures (p=0.026) .Perhaps, iris prolapse can act as a way of entrance of microbes into the eye. In this study, it was shown that organisms with high virulence can increase the possibility of development of endophthalmitis that a significant number of patients with endophthalmitis had positive cultures of Bacillus (3 to 43%) of 7 patients). In studies of Lieb DF and Williams DF, it was shown that all cases of penetrating ocular trauma and culture do not face endophthalmitis during the early recovery. (15 and 16) but the eyes with more virulence of organisms have greater risk of developing clinical infection (16). In this study, the relationship between sclera rupture and positive culture is more significantly and the said issue is because of appropriateness of vitreous for growth of microorganisms and less transparency than the aqueous humor. The positive culture along with the intraocular foreign body has been shown. (p=0.03). However, despite high risk of intraocular foreign body, three eyes with the IOFB positive culture did not have the signs of clinical infection. Most of the previous studies have reported prevalence of endophthalmitis along with the intraocular foreign body (IOFB). (3, 20-21). But Miller and et al. showed that many eyes with IOFB and positive culture had not any signs of clinical injection. They believed that reduction of prevalence of endophthalmitis, despite the positive culture, could be due to the early surgery, bringing out the foreign body and injecting antibiotics into the eye. In this study, although the increased rate of positive culture . was not observed among patients with more than 24-hour delay up to the initial recovery (5), increased risk of endophthalmitis has been observed following delay in the initial recovery and/or taking out IOFB in studies made by Thompson WS and Thompson JT. (14 and 17)In this study, an increased rate of positive cultures was not found following the conflict lens but the increased infection risk has been reported in patients with the conflict lens in the study made by Thompson WS. (14) Comparison of the relative risk factors in endophthalmitis and positive culture without endophthalmitis. Although IOFB with relative risk: 4 causes positive culture, IOFB can increase risk of clinical endophthalmitis SOLELY as much as 1.9 percent. In this study, the delay more than 24 hours had not any significant relationship with the positive culture. (p=0.774) but risk of endophthalmitis was significantly increased. (p=0.047). In the study made by Rohan and et al., it was shown that more than 12-hour delay in the initial recovery can increase risk of endophthalmitis. (18 and 20) The conflict lens is considered a less risk factor in the incidence of positive cultures. (Relative Risk 1) but it has increased endophthalmitis risk as much as 1.9 fold. Of course, such relative increase can be toxic endophthalmitis because of response of body immune system to the lens proteins. In this study, iris prolapse, sclera rupture and intraocular foreign body are identified as risk of positive culture factors following penetrating ocular trauma. Also, it was shown that the positive culture, especially with

more virulence organisms, can increase risk of endophthalmitis. In a study, it has been shown that antibiotic intraocular injection may be effective in prevention of endophthalmitis after the trauma. (19 and 21)

Conclusion

This study showed that bacterial culture is not necessary in penetrating ocular trauma. Moreover, cost of treating these patients, if culture is done, will be increased.

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