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Research Article

Relevance of Intraocular Pressure Measurement in Ulcerative Microbial Keratitis

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Abstract

Purpose: Intraocular pressure measurement in a case of ulcerative microbial keratitis is often neglected as treatment of ulcer takes precedence. However, prolonged rise in IOP can cause optic nerve damage and failure of visual recovery even after complete resolution of keratitis. This prospective longitudinal comparative study was done to evaluate the importance of IOP measurement in cases of ulcerative keratitis.

Methods: 122 cases of ulcerative microbial keratitis were divided into three groups based on their etiology- bacterial (Group A), fungal (Group B) and indeterminate (Group C). Comparative evaluation of IOP between all the three groups was done and results recorded.

Results: On presentation, IOP was significantly high in bacterial and indeterminate group (Group A and C) but subsequently responded to treatment. In fungal keratitis, higher IOP was noted later in the follow up visits. The IOP was also related to the size of ulcer and depth of infiltrate with size more than 5 mm and midstromal level of infiltrate showing a significantly high IOP.

Conclusion: IOP measurement and management although difficult in cases of keratitis if neglected can cause permanent loss of vision.

Keywords: Ulcerative Microbial Keratitis; Intraocular Pressure; Non Contact Tonometry

Introduction

In developing countries microbial keratitis is an important cause of preventable blindness. Infectious keratitis often causes anterior chamber reaction ranging from mild to severe uveitis. Intraocular pressure (IOP) elevation secondary to uveitis is a well-recognized consequence of anterior chamber inflammation [1].

Increased IOP is a risk factor for glaucoma which can result in blindness. Although IOP measurement is a part of routine ophthalmic examination, in cases of microbial ulcerative keratitis it is often missed as management of ulcer takes precedence. Increased IOP even for one to two weeks can cause potential damage to the optic nerve.

Very few studies are available highlighting the importance of elevated IOP in cases of ulcerative keratitis [1-3]. A prospective longitudinal comparative study was done to evaluate the IOP in cases of ulcerative keratitis at the time of presentation and at subsequent follow up.

Material and Methods

122 cases of ulcerative microbial keratitis presenting to the Cornea Services of our institute from June 2018-September2019 were enrolled for the study.

Patients with prior history of glaucoma or ocular hypertension in either eye, viral keratitis or corneal perforation at the time of presentation were excluded from the study.

The cases were classified as bacterial (Group A), fungal (Group B) and indeterminate (Group C) on the basis of clinical examination and microbiological assessment of the corneal scrapings by staining and culture methods in all cases. Group A consisted of 58 patients, Group B of 38 and Group C of 26 patients.

History included pain, redness, discharge, decrease in vision and photophobia. Risk factors for systemic illness (like diabetes mellitus, hypertension, tuberculosis), trauma, contact lens use, dry eyes, use of corticosteroids and other medications were documented.

Ocular examination included visual acuity, corneal sensation, lid abnormalities, size of corneal ulcer and depth of infiltrate on slit lamp biomicroscopy. Anterior chamber reaction was documented and posterior segment examination was done whenever possible.

All the patients underwent measurement of IOP with Non-contact tonometer (NCT) on the day of presentation and at every follow up visit. When NCT was unable to measure IOP due to distorted mires, a bandage contact lens was temporarily used for recording of IOP [4,5].

Due to the limitation posed by hazy media to optic disc assessment and visual field analysis, an IOP greater than 21 mm Hg on any of the visits was considered glaucomatous.

The pain scoring was done in all cases at the time of presentation and at 2 weeks and 6 weeks follow up.

The patients were given appropriate antimicrobial therapy and cycloplegics. Anti-glaucoma therapy was added when IOP was greater than 21mm Hg.

The IOP was correlated to etiology, size of corneal ulcer, depth of the infiltrate, visual acuity, pain score in all the three groups separately.

Results

The age and sex distribution of cases in the study is shown in table 1.

Mean IOP in all the 3 groups at presentation, 2 weeks and 6 weeks is given in table 2.

Age	Group A		Group B		Group C		Total
	Male	Female	Male	Female	Male	Female	
<30 years	2	3	1	2	1	1	10
30-45 years	9	6	11	4	5	3	38
45-60 years	14	11	8	7	5	7	52
>60 years	8	5	3	2	2	2	22
Total	33	25	23	15	13	13	122

Table 1: Age and sex distribution.

Change in IOP from baseline to 2 weeks and 6 weeks was evaluated and compared as shown in table 3. This showed that IOP although high in all the 3 groups at presentation, a significant drop was noted on treatment.

Time in weeks	Group A	Group B	Group C
0	24.4+/- 7.99	22+/- 4.33	27.2+/- 6.403
2	20.5 +/- 4.59	20.04+/- 3.48	22.74+/- 4.6
6	17.3+/- 5.18	19.89+/- 3.23	18.6+/- 4.02

Table 2: Mean IOP.

A comparison of mean IOP was also done between the 3 groups on the basis of etiology and the results were as shown in table 4.

At the time of presentation, IOP was significantly higher in indeterminate group followed by bacterial.

	IOP 0-2 weeks		IOP 0-6 weeks	
	t test	p value	t test	p value
Bacterial keratitis (Group A)	3.21	0.001	5.58	0.001
Fungal keratitis (Group B)	2.2	0.02	2.4	0.01
Indeterminate keratitis (Group C)	2.8	0.005	5.6	0.001

Table 3: Change in IOP.

	0 weeks		2 weeks		6 weeks	
	t test	p value	t test	p value	t test	p value
Bacterial vs Fungal	1.9	0.05	0.55	0.4	2.84	0.005
Bacterial vs indeterminate	1.75	0.05	1.96	0.05	1.06	0.15
Fungal vs indeterminate	4.1	0.001	2.43	0.01	1.20	0.25

Table 4: Comparison of mean IOP.

At 2 weeks follow up, the difference in bacterial vs fungal was insignificant. However, IOP significantly rose in fungal group at 6 weeks.

In bacterial vs indeterminate, the IOP was significantly higher in indeterminate at 2 weeks but insignificant at 6 weeks.

On comparing fungal vs indeterminate, the IOP was significantly high at 2 weeks in indeterminate but insignificant at 6 weeks.

All the groups were divided on the basis of presence of raised IOP and referred to as glaucomatous or non-glaucomatous at the time of presentation.

The size of corneal ulcer was correlated to IOP in all the cases. The details are given in table 5.

Size of ulcer	Group A			Group B			Group C		
	G	NG	Total	G	NG	Total	G	NG	Total
2-5 mm	4	14	18	2	6	8	1	2	3
5-8 mm	19	13	32	13	11	24	12	1	13
>8 mm	3	5	8	3	3	6	5	5	10
	26	32	58	18	20	38	18	8	26

Table 5: Size of ulcer and IOP at presentation.

G for glaucomatous and NG for non glaucomatous

The IOP was significantly high in patients with ulcer size of 5-8mm in Group A ($X^2 = 6.33$, $p < 0.05$) and Group C ($X^2 = 6.76$, $p < 0.05$) but not significant in Group B ($X^2 = 2.06$, $p < 0.5$).

IOP was also evaluated on the basis of depth of infiltrate as shown in table 6.

Infiltrate	Group A			Group B			Group C		
	G	NG	Total	G	NG	Total	G	NG	Total
Superficial stromal	6	20	26	5	6	11	1	3	4
Mid stromal	14	6	20	10	14	24	5	1	6
Deep stromal	4	3	7	1	0	1	7	2	9
Descemetocele	2	3	5	2	0	2	5	2	7
	26	32	58	18	20	38	18	8	26

Table 6: Infiltrate depth vs IOP.

G for glaucomatous and NG for non glaucomatous

When extent of infiltrate was correlated with IOP, IOP was significantly raised in Group A ($X^2 = 10.57$, $p < 0.02$). In Group B and Group C, the corresponding values were ($X^2 = 3.66$ with $p < 0.5$) and($X^2 = 5.43$ with $p < 0.5$), respectively and were insignificant.

The maximum incidence was seen at mid-stromal extent of the infiltrate. On applying Fisher Exact test between infiltration at mid stromal level and others, it was found significant in Group A ($p = 0.0066$) while statistically not significant in Group B and Group C.

The visual acuity at 6 weeks follow up is given in table 7.

The IOP was not significantly related to visual acuity (BCVA) in any of the 3 groups.

Vision	Group A			Group B			Group C		
	G	NG	Total	G	NG	Total	G	NG	Total
6/6-6/18	15	14	29	5	5		3	2	5
6/18-6/60	7	14	21	7	7		5	3	8
6/60-3/60	3	2	5	4	4		5	1	6
3/60-PL	1	2	3	2	2		5	2	7
			58						26

Table 7: Visual acuity at 6 weeks.

Pain scoring was done for all the patients at 0, 2 and 6 weeks as shown in table 8. A significant decrease in pain score was noted with treatment in all the three groups.

	0 weeks	2 weeks	6 weeks
Bacterial keratitis (Group A)	6.86 +/-1.04	3.07 +/- 1.51 p < 0.001	1.93+/- 1.53 p < 0.001
Fungal keratitis (Group B)	5.47+/- 1.33	2.68 +/- 0.65 p < 0.001	1.605+/- 1.04 p < 0.0001
Indeterminate keratitis (Group C)	6.85+/- 1.85	3.27 +/- 1.45 p < 0.001	2.04+/- 1.285 p < 0.001

Table 8: Pain score.

Discussion

A patient of keratitis usually presents with pain, redness, photophobia and decreased vision. Pain in almost all cases is attributable to loss of epithelium and subsequent exposure of nerve endings. But it is often seen in some cases of keratitis that pain remains out of proportion to the ulcer findings. In such cases it is believed that inflammation due to anterior chamber reaction plays an important role and therapy to counter inflammation would go a long way in preventing permanent damage to trabecular meshwork and optic disc [1].

Documentation of IOP in cases of keratitis is always difficult. Patient is often in severe pain and uncooperative for measurement of IOP. All contact methods of measurement of IOP are avoided due to non-intact epithelium.

A non-contact tonometry in these cases can serve as a reliable method of IOP assessment as opposed to digital palpation, which is often employed but gives a very subjective and gross assessment.

In our study, we measured IOP at presentation and at subsequent follow up visits of the patient and anti-glaucoma therapy was started based on IOP readings.

A significant rise of IOP in our study was seen in patients with bacterial and indeterminate keratitis.

These findings can be explained on the basis that the anterior chamber reaction is usually more severe in cases of bacterial keratitis but responds to appropriate therapy and anti-glaucoma treatment.

Increased IOP was seen in cases of fungal keratitis later in the study period. This could reflect the fact that treatment in cases of fungal keratitis is often prolonged and protracted and hence the delay in control of IOP as compared to bacterial keratitis.

Increased IOP in cases of indeterminate keratitis can be due to persistent inflammation owing to lack of targeted therapy because of inconclusive microbiological work up.

In our study, increased IOP was also found in ulcers with size more than 5 mm. This was similar to a study by G.J. Lee., *et al*. where they found elevated IOP in larger ulcer size of more than 4mm [3]. As the ulcer size increases it leads to increased inflammation and hence increased IOP.

Increased IOP was also noted in mid stromal and deep stromal level of infiltrate. Uneven distribution of proteoglycans and arrangement of collagen fibrils play a role in increased posterior stromal thickness [6]. This may possibly lead to relative angle closure. Associated trabeculitis may compound the rise in IOP.

Both these findings were seen more in cases of bacterial keratitis. Sakiyalak., *et al.* in their study had seen higher rates of glaucoma procedures after active infection was controlled in patients of fungal keratitis although it was not found to be statistically significant [2].

We correlated pain scores over the duration of disease and found a significant relief in pain with therapy [7]. Although this

can be attributed to healing of keratitis but in some patients severe pain is reported even after complete resolution of ulcer. This shows that pain could be in part due to high IOP and can be taken care of with proper IOP management.

Conclusion

Monitoring IOP in patients of keratitis although very important is often neglected in the face of multiple difficulties like an uncooperative patient due to extreme pain and an infected discontinuous epithelium. The extreme anterior chamber reaction and hypopyon associated with keratitis frequently cause trabeculitis or mechanical damage to the angles due to debris. This damage if not picked on early in the course of disease can lead to irreversible glaucoma and permanent loss of vision in spite of successful resolution of keratitis. A blanket treatment of anti-glaucoma drugs in cases of keratitis, although employed by some has danger of being epitheliotoxic to an already compromised epithelium.

Thus it is important to monitor IOP with non-contact methods and treat if required.

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