A COMPREHENSIVE STUDY OF BULLOUS KERATOPATHY

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ABSTRACT

BACKGROUND

Bullous Keratopathy is emerging major cause of treatable blindness nowadays in the era of modern ophthalmology. It represents the terminal stage of severe epithelial oedema occurring usually in diseased eyes. This study has been conducted to enlighten the various aetiological factors, its management both medical and surgical modalities in Government setup. In most cases, aetiology was found to be surgical trauma following cataract surgery with posterior chamber intraocular lens implantation.

MATERIALS AND METHODS

98 patients (100 eyes) who attended the outpatient and inpatient Department of Ophthalmology at Government Vellore Medical College who are diagnosed clinically to have Bullous Keratopathy were enrolled for this study after getting their consent. Detailed history taking, detailed general examination to detect any systemic disease like Diabetes/Hypertension were undertaken. Complete ocular examination, fundus examination was done if it was possible. The IOP was measured. Corneal thickness was measured by Haag-Streit pachymeter. 2% fluorescein staining was carried out to determine the status of corneal epithelium. Relevant laboratory investigations were also done. This is a hospital-based study. The period of our study was from June 2015-June 2016. Ethical committee approval was obtained for conducting the study.

RESULTS

Bullous Keratopathy is a common clinical condition, which occurs in elderly age group, commonly occurring in sixth decade followed by increased incidence in fifth decade well correlated with the age incidence of senile cataract. Study comprised of equal male and female patients of ratio 48:50. Left eye involved in 51.1% cases as more ocular surgeries were done in left eye. About 75% of the cases, the aetiology was due to postsurgical complication. 76 patients, out of 98 cases of Bullous Keratopathy were reported within 1 to 3 years of postoperative period. Most common postsurgical cause was following extracapsular extraction with PCIOL implantation. The bullae were mostly found in centre and superior part of cornea corresponding well with surgical endothelial damage. Bullous Keratopathy associated with raised IOP was seen in 18 out of 98 cases. In these, 15 cases were found to be following ocular surgeries while only 3 cases were due to primary glaucoma. 80 cases were treated with hyperosmotic agents. 24 patients out of 98 cases of Bullous Keratopathy had undergone penetrating keratoplasty. In 19 patients of painful Bullous Keratopathy, anterior stromal puncture was tried. The procedure was repeated in 5 patients. Of the 19 patients, 7 showed the symptomatic relief while 7 patients who had worsening of pain and other symptoms underwent PKP subsequently.

CONCLUSION

Bullous Keratopathy occurs more commonly in sixth decade followed by fifth decade in this study correlates well with the incidences of senile cataract. Pachymetry was the most useful indicator of endothelial decompensation in this study. Patient who underwent extracapsular extraction with posterior chamber IOL implantation were found to be most susceptible for development of Bullous Keratopathy.

KEYWORDS

Bullous Keratopathy, Pachymeter, Penetrating Keratoplasty, Anterior Stromal Puncture, Bandage Contact Lens.

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BACKGROUND

Bullous Keratopathy is a common clinical condition, which causes visual loss and leads to painful eye, if not properly managed. It represents the terminal stage of severe epithelial oedema occurring usually in diseased eyes. Management of corneal oedema and bullous keratopathy depends upon the correct understanding of aetiopathogenesis. In most cases, aetiology was found to be surgical trauma following cataract surgery with posterior chamber intraocular lens implantation.[(1)]

AIM AND OBJECTIVE

The aim of our study is to enlighten the various aetiological factors, its management both medical and surgical modalities in government setup.

MATERIALS AND METHODS

98 patients who attended the outpatient and inpatient departments of GVMCH from the period of June 2015 to June 2016 were selected based on the clinical diagnosis of Bullous Keratopathy for the clinical study of Bullous Keratopathy.

In all the cases, detailed clinical history was obtained. The importance given to: 1) Duration of defective vision. 2) Type of pain, its duration and extent of pain noted. 3) Presence of coloured halos. 4) Previous history of any eye surgery. 5) Duration between date of surgery and developments of symptoms were noted. Family history of glaucoma obtained.

Detailed General Examination to detect any systemic disease like Diabetes/Hypertension were undertaken.

A thorough ocular examination including: 1) Best corrected visual acuity. 2) Eye posture, function of the lids, status of conjunctiva. A detailed examination of the anterior segment of the eye with SLE and the findings were recorded using diagrams. Of particular importance, the epithelial surface irregularity, presence of bullae, epithelial oedema, stromal oedema types and distribution of corneal vessels were looked for and noted. Abnormalities of the anterior chamber regularity, depth and content were observed. Iris examination including colour pattern, atrophic patches, neovascularisation and synechiae. State of lens pseudophakic or aphakic and if phakic, clear or cataractous changes were also noted. Fundus examination was done if it was possible. The IOP was measured. Corneal thickness was measured by Haag-Streit pachymeter. 2% fluorescein staining was carried out to determine the status of corneal epithelium. Relevant laboratory investigations were also done.

Inclusion Criteria

1. Epithelial bullae of any size, ruptured or intact.
2. Presence of epithelial (or) stromal oedema.
3. The above two criteria in the presence of suggestive clinical history (or) any pathology in the eye, which causes endothelial decompensation.

Exclusion Criteria

1. Known case of dry eye (Schirmer's-1, less than 10 mm in 5 minutes).
2. Patient who have already undergone keratoplasty for bullous keratopathy.
3. Patients with trichiasis and deformed lid anatomy.
4. Patient with previous posterior segment pathology as evident by B-scan, which have little visual prognosis.
5. Patient with chronic dacryocystitis. They were taken only when the conjunctival swab were culture negative after dacryocystectomy (or) dacryocystorhinostomy.

RESULTS

In our study, Bullous Keratopathy is most commonly in older age group, commonly in sixth followed by fifth decade, well correlated with the age incidence of senile cataract. In older age group, Bullous Keratopathy occur mostly, postoperatively following the cataract surgery as a result of endothelial cell loss. In younger age group, Bullous Keratopathy occur predominantly due to congenital endothelial dystrophies and trauma.[2] There was no sexual preponderance in our study. 48.9% were males and 51.1% being females. Left eye was more involved in this study due to the fact that more ocular surgeries are done in left eye.[3] In cases of congenital endothelial dystrophies, both eyes were involved.

Presenting Complaints	No. of Cases	Percentage
Pain, Redness, Watering	54	55.1
Gradual Loss of Vision	29	29.6
Coloured Halos	6	6.1
Corneal Haziness Since Childhood	6	6.1
History of Trauma	3	3.1

Table 1

Pain, redness and watering were the main presenting complaints of the patient followed by the gradual loss of vision.[4] 6 patients who noted coloured halos was diagnosed to have narrow angle glaucoma, Fuchs endothelial dystrophy and Chandler's syndrome.

Bullous Keratopathy in Surgical vs. Nonsurgical Cases

Category	No. of Patients	Percentage
Surgical	76	77.6
Nonsurgical	22	22.4

Table 2

In our study, more than 77.6% of the cases were due to postsurgical complication following ocular surgeries. 22.4% of the cases were due to nonsurgical causes like trauma, uveitis (or) endothelial dystrophies. Surgical trauma leading to Bullous Keratopathy makes the patient come to the hospital at earliest and hence the early reporting occurred within 1 to 3 years of postoperative period.[5] More than 45% of the patients came to the hospital within this period followed by those who reported 3 to 6 years after surgery.

Nature of the Surgery in Bullous Keratopathy in 76 Cases

Nature of Surgery	No. of Patients	Percentage
ECCE	25	32.8
ECCE with PC IOL	42	55.2
Intracapsular Extraction	3	4.2
AG Surgery	1	1.3
ACIOL Implantation	4	5.2
Trab with PCIOL	1	1.3
Table 3		

Most common cause of endothelial decompensation in our study was ECCE with PCIOL implantation. It is because more endothelial damage occurs when doing it with an inexperienced hands, excessive manipulation during IOL implantation or malposition of IOL postoperatively.[6] As we were doing less number of ACIOL, AG surgery, Trabeculectomy with PCIOL Implantation, these incidences were less in this study.

Corneal Examination under Slit-Lamp Biomicroscopy

Corneal Examination	No. of Patients
Epithelial Oedema with Bullae	67
Stromal Oedema	69
Descemet's Folds	11
Descemet's Detachment	2
Advanced Superficial Corneal Vascularisation	22
Deep Vascularisation	9
Total Corneal Oedema with Very Hazy Cornea	21
Table 4	

On examination with slit lamp biomicroscopy, epithelial oedema and stromal oedema were seen commonly in most of the cases. The site of bullae more commonly seen in the centre and superior part of the cornea correlated well with surgical endothelial damage probably due to faulty IOL implantation technique.[7] Descemet's folds were seen in 11 patients (most of them following trauma).

This may be due to stretching of Descemet's membrane because of increase in IOP. Detachment of Descemet's membrane present in 2 cases of pseudophakic Bullous Keratopathy as a result of surgical trauma. Advanced superficial and deep vascularisation were present in 22 cases. As a result of loss of compactness of cornea due to longstanding corneal oedema leads to separation of lamellae and hypoxia due to corneal oedema.

Pachymetry

Central corneal thickness measured in 53 cases and the readings were as follows:

Pachymetry Readings	No. of Cases
0.7 to 0.8 mm	21
0.9 to 1.0 mmm	29
1.0 to 1.1 mm	03
Not Recordable	45
Table 5	

Haag-Streit pachymetry used to measure corneal thickness was done only in 53 cases. For others, it was not possible due to poor cooperation of patients and hazy irregular cornea. Majority of them showed an increase in pachymetry reading due to corneal decomposition, hence, it can be taken as an index of endothelial functional integrity.[8]

Other Anterior Segment Abnormalities

- Shallow anterior chamber - 21.
- Vitreous touch in cornea - 29.
- Cells, flare - 08.
- Iris atrophy - 01.
- Anterior synechiae - 11.
- Up drawn pupil - 09.
- Epithelialisation of anterior chamber - 02.

Shallow AC was found in 21 cases primarily due to glaucoma or Iridocorneal Endothelial Syndrome secondarily due to vitreous bulge in anterior chamber. Epithelialisation of anterior chamber due to faulty surgical technique following cataract surgery (or) trauma also. Up drawn pupil in 9 cases were due to loss of vitreous during surgery. Cells, flare and anterior synechiae observed in few cases due to uveitis. In our study, 18.3% of the patients presented with raised IOP, 73.4% had normal intraocular pressure and in 8.2% of the patients it was not recordable.

Preoperative Diagnosis of Patients with Bullous Keratopathy

Postoperative endothelial decompensation	53
Vitreous touch syndrome in aphakic eyes	16
Uveitis	8
Congenital hereditary endothelial dystrophies	6
Keratoconus	3
PACG and POAG	3
Fuchs endothelial dystrophy	1
Descemet's membrane detachment	2
Posttraumatic cases	5
Chandler's syndrome	1
Table 6	

Majority of Bullous Keratopathy, which occur following postoperatively as a complication of cataract surgery. In this study, the main causes of Bullous Keratopathy were due to endothelial decompensation.[7]

The vitreous touch is disastrous to the corneal endothelium, directly by causing decompensation, indirectly by raising the IOP, leading on to secondary glaucoma and corneal oedema. Intracapsular and extracapsular extraction were the most commonly affected group in vitreous touch decompensation.[9] Detachment of Descemet's membrane constitute 2% of cases. It was due to localised endothelial

failure and unprotected stroma. The six CHED cases due to primary endothelial absence (or) defect lead to corneal oedema. 8 uveitis patients developed Bullous Keratopathy due to direct damage of the endothelium due to inflammatory cells or due to raised IOP secondary to uveitis and synechiae.

Medical Line of Management

Treatment Measures	No. of Cases	Percentage
Hyperosmotic Agents	80	81.6
Topical and oral steroids	11	11.3
Antiglaucoma treatment	7	7.1
Table 7		

As generally known, medical management with 5% hypertonic saline usually is a temporary measure to reduce epithelial oedema and symptomatic measure to relieve pain was tried in 81.6% of the cases.[10] Uveitis was treated with both systemic and topical steroids. Large doses were tried to control the uveal inflammation and to prevent endothelial damage. Patients with primary and secondary glaucoma responded well to antiglaucoma drugs. In majority of patients, the intraocular pressure fell significantly and subsequently antiglaucoma surgery were undertaken.

Surgical Line of Management

Surgical Technique	No. of Cases	Percentage
PKP only	21	38.8
With Trabeculectomy	2	3.8
PKP with IOL explanation	1	1.9
Trabeculectomy only	3	5.5
Cyclocryotherapy	1	1.9
Anterior Stromal Puncture	19	35.1
Conjunctival Flap	1	1.9
Bandage Contact Lens	6	11.1
Table 8		

Since medical management was ineffective, surgery was resorted to most of the cases. Penetrating Keratoplasty was a major surgical procedure tried in 21 cases and penetrating keratoplasty is indicated for optical rehabilitation in patients with Bullous Keratopathy. Pseudophakic Bullous Keratopathy is the most common indication for penetrating keratoplasty.[11] In very few cases of vitreous touch syndrome with Bullous Keratopathy, penetrating keratoplasty with anterior open sky vitrectomy was done in view of clearing the vitreo corneal adherence. The graft size depends upon the extent of corneal involvement. In Bullous Keratopathy with Chandler's Syndrome, penetrating keratoplasty with trabeculectomy was done.[12] One case of painful intractable glaucoma with Bullous Keratopathy had undergone cyclocryotherapy (with temp.-60 to-70^0 C for 60 seconds, 4 mm from limbus) for control of glaucoma and pain.

Anterior Stromal Puncture

Anterior stromal puncture was tried in 19 patients with painful Bullous Keratopathy. 12 cases showed improvement in their symptom, in 5 patient's procedure was repeated. 7 patients showed no improvement of symptoms, since anterior stromal puncture failed penetrating keratoplasty was done in those 7 patients.[13]

Procedure	No. of Cases
Anterior Stromal Puncture Cases	19
Repeated Anterior Stromal Puncture Done	5
Worsening of Symptoms and PKP Done	7
Table 9	

Bandage contact lens were applied in 6 cases and conjunctival flap was applied to one patient with severe pain and watering with no perception of light vision.[14]

DISCUSSION

Bullous Keratopathy is a common clinical condition, which occurs in elderly age group commonly occurring in sixth decade followed by increased incidence in fifth decade well correlated with the age incidence of senile cataract. Study comprised of equal male and female patients of ratio 48:50. Left eye involved 51.1% cases in Bullous Keratopathy as more ocular surgeries were done in left eye. About 55% of the patients presented with complaints of pain, redness, watering followed by gradual loss of vision in 30% of cases. Approximately, in about 75% of the cases, the aetiology was due to postsurgical complication.

76 patients, out of 98 cases of Bullous Keratopathy were reported within 1 to 3 years of postoperative period. 34 patients out of 98 cases of Bullous Keratopathy were reported within 1 to 3 years of postoperative period. Most common postsurgical cause of Bullous Keratopathy in this study was following extracapsular extraction with PCIOL implantation. 42 patients out of 98 had undergone previous ECCE with PCIOL, while 25 patients developed Bullous Keratopathy following ECCE. In remaining 31 patients, Bullous Keratopathy occurred due to multiple causes.

On examination with slit lamp, stromal and epithelial oedema was seen commonly in 69 cases. The bullae were mostly found in centre and superior part of cornea[11] corresponding well with surgical endothelial damage. Descemet's membrane detachment was seen in 2 cases of Pseudophakic Bullous Keratopathy. The corneal thickness measured with pachymeter increased in almost all the cases. It was not recordable in 45 patients due to poor cooperation and very hazy cornea. So, it can be taken as an index of corneal endothelial decompensation. Vitreous touch to the endothelium seen in most of the Extracapsular Extraction cases.[12] Out of 25 cases of ECCE, 16 cases were presented with vitreo corneal touch. Shallow AC, up drawn pupil, epithelialisation of anterior chambers were seen in few cases. Bullous Keratopathy associated with raised IOP was seen in 18 out of 98 cases. In these, 15 cases were found to be following ocular surgeries while only 3 cases were due to primary glaucoma. The main cause of Bullous Keratopathy

in this study was due to postoperative endothelial decompensation. Out of 98 cases, 53 were mainly due to postoperative decompensation followed by vitreous touch to the endothelium. In 16 cases, uveitis, CHED, Descemet's membrane detachment were the other minor causes.

Main medical mode of treatment given was topical hyperosmotic agents in this study. 80 cases were treated with hyperosmotic agents. Topical steroids and antiglaucoma treatment were given to only few cases of Bullous Keratopathy due to uveitis and glaucoma, respectively. Majority of the patient responded well with hyperosmotic agents. Cases showing no improvement with medical treatment were taken up for surgery.[15]

Major surgical procedure performed was penetrating keratoplasty. 24 patients out of 98 cases of Bullous Keratopathy had undergone penetrating keratoplasty. In one patient, IOL was explanted during penetrating keratoplasty and one patient underwent trabeculectomy associated with PKP.[16] In 19 patients of painful Bullous Keratopathy, anterior stromal puncture was tried. The procedure was repeated in 5 patients. Of the 19 patients, 7 showed the symptomatic relief while 7 patients who had worsening of pain and other symptoms underwent PKP subsequently.

Bandage contact lenses were given only to 6 patients because of higher cost factor and poor socioeconomic status of the patients attending Government Hospital. The other factors curtailing the use of bandage contact lenses include old age, poor vision in other eye, care and maintenance associated with bandage contact lenses.

In one patient of painful Bullous Keratopathy with good vision, other eye conjunctival flap was done.[17]

CONCLUSION

Bullous Keratopathy is more common in sixth decade followed by fifth decade in our study correlates well with the incidences of senile cataract. Gender incidence was equal in this study. Left eye was found to be more involved in our study and maybe due to more surgeries done in left eye. The patients with Bullous Keratopathy commonly complained of pain, redness and watering followed by gradual loss of vision. Pachymetry was the most useful indicator of endothelial decompensation in our study. Patient who underwent extracapsular extraction with posterior chamber IOL implantation were found to be most susceptible for development of Bullous Keratopathy. Slit lamp examination showed epithelial and stromal oedema in most of the cases. The most common site of bullae was in centre and superior part of the cornea correlating well with areas of surgical trauma.

Hyperosmotic agents were the main medical modality of treatment given in our study. Penetrating keratoplasty was the main surgical modality of treatment in our study followed by anterior stromal puncture. Pseudophakic Bullous Keratopathy and aphakic Bullous Keratopathy were the main indications for penetrating keratoplasty. It gave an excellent result in most of the cases. Eyes being the index of the world, their protection from Bullous Keratopathy by improving surgical skills and its management to restore the vision is the main challenge to the modern ophthalmology. As the penetrating keratoplasty is the main surgical modality for visual restoration in these patients, promotion of eye donation should be encouraged.

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