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RESEARCH ARTICLE

A STUDY ON OCULAR CHEMICAL INJURIES WITH THEIR WISUAL OUTCOMES

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Abstract

Ocular chemical Injury comprises about 8-18% of overall ocular trauma. It is caused by various types of acids and alkalis.Alkalis penetrate deep and cause severe injury. Acid cause lesser severity of burns.It is more common in age group of 20-40 years.It is the true ocular emergency and requires immediate intervention. It can cause a greviousvisual impairment in younger economically productive age group. Hence, it is necessary to evaluate the damages caused by it with optimal intervention to restore vision. This study enables the analysis of current management of ocular chemical injury and its effect on the visual outcomes of the patients.

Introduction:-

Ocular chemical Injury comprises about 8-18% of overall ocular trauma.[1]Acids ,for example - Sulfuric acid, Acetic Acid, Hydrochloric acid, Sulphurous acid, Hydrofluoric acidcause comparatively lesser severity of burns than alkalis because acids denature the proteins and form a protective layer over the ocular surface.Alkalis penetrate deep and cause severe injury. Hydroxyl (OH) ion causes saponification of the cell membrane constituents which results in cell disruption and cell death and the cation are responsible for the penetration process of respective alkali. Examples -Lime particles, colors used during Indian festivals Ocular chemical injuries produce extensive damage to the ocular surface epithelium, conjunctiva, cornea, and limbal stem cells which results in diminution of vision. Emergency management early and aggressive treatment with close long-term monitoring is the single most important factor in determining the visual outcome.

The severity of injury depends on nature of chemical agent ,duration of exposure.

Classification-

1)Ropper Hall Classification

GRADE	VISUAL PROGNOSIS	APPEARANCE OF CORNEA	LIMBAL ISCHEMIA
I	Good	Epithelial Damage	None
II	Good	Haze but iris visible	<1/3
II	Guarded	Total epithelial loss with haze that obscures iris details	1/3 to ½
IV	Poor	Cornea opaque with iris	>1/2

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		and pupil obscured	

Table 1:-

Image 1:- Grade IV Dua's ocular chemical injury with inferior 6 clock hours of limbal ischemia.

Pathophysiology

Importance of limbal stem cells-

Devanger and evansen in 1971 first proposed the concept of involvement of the limbal epithelium in the regeneration and renewal of the corneal epithelium .[(2)].These are pleuripotent stem cells. They can regenerate specific differentiated cells in body.Epithelium is maintained by continuous centripetal movement of the peripheral corneal epitheliumAccording to the X, Y, Z hypothesis proposed by Thoft and Friend.. They have a rich blood supply and appear as ridges (Vogt). These are known as limbal palisades of Vogt.They are poorly differentiated and maintain their stemness through a combination of inherent cellular characteristics and the presence of favourable microenvironment at limbus.Transient amplifying cells or daughter cells are derived from limbal stem cells, maintain epithelial mass during epithelial turnover and wound healing. Corneal epithelial regeneration occurs regeneration of the corneal epithelium occurs in a centripetal and a circumferential fashion.Following severe chemical injuries, resurfacing of the corneal epithelium is associated with the conjunctivalisation, deep stromal vascularisation, persistence of goblet cells within the corneal epithelium and recurrent erosions.

The clinical course of ocular chemical injury –

1)Immediate-

It begins from the time a chemical agent comes in contact with the ocular surface[4].The factors for estimating the extent of ocular chemical injury and prognosis include total area of the corneal epithelial defect, the area of the conjunctival epithelial defect, the amount of clock hours or degrees of limbal involvement, the area and density of corneal opacification, and increased IOP on presentation and lens clarity .

2)acute-

The first seven days after chemical eye injury constitute the acute phase of recovery. During this time, various inflammatory actions begin to take place over the ocular surface. In this stage, usually IOP(intraocular pressure) rises in a bimodal manner.[5]

3)early reparative (8–20 days)-
Early reparative phase starts 8–20 days after the injury. In this phase, the immediate regeneration of ocular surface epithelium and acute inflammatory events occur. Its further proceeds to chronic inflammatory response, stromal repair, and scarring.[6,7]In this stage various digestive enzymes such as collagenase, metalloproteinase, and other proteases are released from the polymorphonuclear leukocytes and the healing epithelium. Due to their action a persistent corneal epithelial defect can get converted to ulcer[8,9,10,11]

4) and late reparative phases –
This sets in after 3 weeks of initial injury. In this phase completion of healing occurs. Complications if any, also occur in this phase. Breakdown of own ocular tissues leads to the chronic inflammatory reaction. These damaged tissue products act as new antigens. This causes invasion of the leukocytes and macrophages.[12,13] Rise in IOP occurs which is resistant to the treatment. It may need long term antiglaucoma therapy or surgical therapy. Complication like corneal scarring, dry eye, symblepharon, cicatricial entropion or ectropion may occur subsequently

Materials and Methods:-
The study was conducted in compliance with the institutional ethical committee and study protocol. The study was in compliance with the ICMR guidelines for biomedical research in human subjects, 2017. 100 eyes were studied.

Study Method:-
First visit-Thorough history of the patients including name, age, sex, address, contact information, chief complaints, history of presenting illness, past, personal and family history was taken.

Thorough ocular examination including slit lamp examinationof anterior segment and fundus examination if possible was done.Threatment was started and patients were foloowed up.

Follow up visits-
These included visits on day1, day2, day5 day 7, day 10, day 17, day 30 of initial chemical injury.

Results And Discussion:-
Incidence in our study:
Total 100 eyes were enrolled in the study.In the present study, majority of the population affected was younger age group. Maximum patients were in age group from 20 to 40 years (72 patients) 5 cases were less than 10 years of age and 33cases above 40 years of age.

Grade of Injury-
Table 5:- Distribution of the study subjects based on Duas grading.

Duas grading	Frequency	Percentage
Grade I	7	7.00
Grade II	38	38.00
Grade III	39	39.00
Grade IV	6	6.00
Garde V	4	4.00
Grade VI	6	6.00
Total	100	100.00

4) Management-
Thus, according to Dua's grading, out of 7 eyes presented with grade I injury none required surgical management. 3eyes with Grade II injury, required AMT. 26 eyes out of 39 eyes presenting with Grade III Injury required Amniotic Membrane Transplantation(AMT). All eyes of Grade 4 injury required AMT. Out of 4 eyes presenting with Grade V injury, 3 required AMT, 1 required AMT with symblepharon release .Out of 6 eyes presenting with Grade VI injuries, 3 required Amniotic Membrane Transplantation, 2 required AMT with symblepharon release, 1 required penetrating keratoplasty and Simple limbal epithelial transplantation . Thus 100% eyes above grade IV injury required some surgical management.

Final visual outcome-

Final visual outcome depended on Grade of injury. It was observed that according to Dua's grading, 100%eyes of Grade I injury had final visual outcome better than or equal to 6/12.

94.73 eyes with Grade II injuries had final visual outcome better than or equal to 6/12. Amongst eyes having Grade III injuries 46.15 % final visual outcome better than or equal to 6/12 had final BCVA more than or equal to 6/12 and 53.84 patients had BCVA between 6/12 to 6/60. There were 6 patients with Grade IV injury. 4 had final BCVA between 6/12 to 6/60 and 2 had vision ≤6/60. More than 90 % patients with Grade V and Grade VI injury had poor final visual outcome (less than 6/60).The results were consistent with the previous studies(72),(36).

Thus, according to Dua's classification, Grade I and II have good prognosis. Grade III, IV injuries have moderate and Grade V and VI have poor prognosis.

Table 6:- Distribution of final visual outcomes of study subjects based on Dua's Grading.

Duas grading	**≥6/12 (good)**		**<6/12 to >6/60 (fair)**		**≤6/60 to LP (poor)**		**Total number**
	No^r	%	No^r	%	No^r	%	
Grade I	7	100	0	0	0	0	7
Grade II	36	94.73	2	5.26	0	0	38
Grade III	18	46.15	21	53.84	0	0	39
Grade IV	0	0	4	66.66	2	33.33	6
Grade V	0	0	1	25	3	75	4
Grade VI	0	0	0	00	6	100	6

Conclusion:-

From the present study, it can be concluded that according to Dua's classification, Grade I and II have good prognosis. Grade III, IV injuries have moderate and Grade V and VI have poor prognosis. According to Ropper Hall classification, grades I and II have good prognosis, grade III has good to moderate and grade IV injuries have poor prognosis despite of treatment.

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