Review Article

A REVIEW ON MANAGEMENT OF AMBLYOPIA

ABSTRACT

Amblyopia is a visual cortex neurodevelopmental condition caused by abnormality in vision during childhood. It is one of the commonest cause of loss of vision in early age. Its occurs due to abnormal development of visual cortex. The part receiving signals from the diseased eye does not receive it properly and thus develops abnormally. This abnormal development during the critical period of growth of child results in brain damage. Depending on its aetiology the types of amblyopia are Strabismic amblyopia, Visual deprivation amblyopia, Anisometric, Ametropic, Meridional, Toxic amblyopia.

Clinical features are visual acuity is reduced, effect of neutral density filter, Crowding phenomenon is present. Complications of amblyopia include Lazy eye become weak permanently, eye may move out from visual axis (squintness). When treating amblyopia our goal is that the eyes will work together in unison at a more equal level, this will create clear vision in the lazy eye. Amblyopia is treated in a variety of ways depending on the seriousness of the disease and the patient's age. Patching of the non-amblyopic eye, as well as treatment with drugs like atropine, are common treatments . Vision therapy and some modifications to spectacles and contact lenses have been discovered to be effective in the treatment of amblyopia in recent years. Modern Treatment- Falling Blocks, Occlu-pad.

With current breakthroughs in amblyopia therapy, the success rate of a multimodal strategy is also improving. The purpose of this review article is to present information on the management of amblyopia. Literature on AMBLYOPIA MANAGEMENT has been taken from PubMed, Scopus, Science Direct and other internet resources.

KEYWORDS - Amblyopia, Strabismus, Vision therapy

INTRODUCTION

Amblyopia is described as reduction of best-corrected visual acuity in any of the eyes that cannot be credited with any changes in structure of eye.(1) It is made two greek words amblyo meaning dull and opia meaning vision, therefore it is also called as dullness of vision.

It is decrease of visual acuity caused due to abnormal binocular interaction occurring in any of the eyes as a result of patterned vision deprivation during the critical period, for which no

cause can be noticed during the physical examination and which in suitable cases reversible by therapeutic measures.

Basically any visual impairment in early life, due to abnormal visual development is a potential risk factor for amblyopia.

Its other clinical features include less sensitivity to contrast, spatial distortion & contour detection. When different sizes of letters are in a straight line or surrounded by bars , the visual acuity is affected. This is a feature of the developing visual system found in amblyopic children.

Premature infants, growth retardation, or family history of amblyopia are more than four times more likely to have amblyopia. Treatment failure is more likely in dense amblyopia, meridional amblyopia, and if disease is discovered after age of 6.(2)

It is diagnosed by a difference in visual acuity between the eyes of two lines /visual acuity< 20/30 with best correction in any refractive error.(3)

Historically, amblyopia was considered as monocular disorders which lead to binocular dysfunction. (4)

EPIDEMIOLOGY

- Responsible for more cases of childhood- onset U/L decreased vision than all other causes combined.
- MCC of U/L visual impairment in adults<60 years
- Prevalence increased in children with -Family h/o amblyopia
  -Premature babies
  -Developmental delay
- Prevalence of this disease is about two percentage in the population

ETIO-PATHOGENESIS

ETIOLOGY

- Errors of refraction
- Cataract
- Optic nerve disorders
- Diseases of retina
- Any pathology in cornea
- Opacities
- Squint

PATHOPHYSIOLOGY

Amblyopia is a visual cortex neurodevelopmental condition caused by abnormality in vision during childhood. It is one of the commonest cause of loss of vision in ealy age. Its occurs

due to abnormal development of visual cortex. The part receiving signals from the diseased eye does not receive it properly and thus develops abnormally. This abnormal development during the critical period of growth of child results in brain damage.

During the initial period of life, the development of neuro-retina occurs rapidly with the help of stimulus from eye. It slows down but continues till around eight years of age. By the eight year of life proper and complete development of eye and brain simultaneously takes place.

If there is any abnormal visual signal to brain due to causes like squint, refractive error etc then during this time the growth process slows down, leading to a reduction in vision in eyes. When the vision quality is restored , the improvement continues - immediately in the first two or three years and gradually until eight years. It is crucial that amblyopia is diagnosed early and treatment is given. This way vision can be easily restored. After full development, treatment is no longer helpful as development of neuro-retina is already complete. Ocular examination is usually not abnormal. Field of vision and colour vision are also not abnormal.

Amblyopia is referred to as 'lazy eye'. The patients also use this term sometimes to refer to blurring of vision ,therefore it is important to make the distinction between the two with the patient(5)

Risk factors

They are:

• Premature delivery

• Growth retardation

• Or having a family history.

Natural variables, which include maternal drug abuse during pregnancy have been cited as related to an increased risk of amblyopia.(6)

TYPES OF AMBLYOPIA

1. Strabismic amblyopia

- Seen in patients with unilateral constant squint who strongly favour one eye for fixation from birth to 6 years of age.
- Seen far more often in esotropes than the exotropes.
- Most common form of amblyopia
- Strabismic amblyopia shows better pattern acuity.
- Neutral density filter effect is seen.
- eccentric fixation is seen.

2. Stimulus deprivation amblyopia

- Amblyopia ex anospia or disuse amblyopia
- Caused by those conditions wherein one eye is prevented from seeing early in life.
- Most common cause is congenital cataract
- Other causes include ptosis, opacity in cornea ,vitreous haemorrhage
- Most rare and damaging
- Treatment is difficult

3. Anisometric amblyopia

- Refers to the amblyopia occurring in an eye having higher degree of refractive error than the fellow eye.
- Known as suppression amblyopia, Straight eye amblyopia
- 2nd most common amblyopia.
- Cause of amblyopia include unequal images in fovea in both eyes , visual deprivation etc
- Most common in anisohypermetropia >anisomyopia.
- Mild degree of hyperopic or astigmatism anisometropia ---(1-2 D)--- mild amblyopia
- Mild myopic anisometropia ---(less than-3 D)--- NO AMBLYOPIA
- Unilateral high myopia (-6 D)- SEVERE AMBLYOPIA

4. Isometric amblyopia

- Bilateral amblyopia that occurs in children with bilateral, high, approximately equal, uncorrected refractive error.
- Result from effect of the blurred retinal images alone.
- Commonly due to high hyperopia or astigmatism.
- Hyperopia> +5 D
- Myopia> -10D
- Astigmatism> 2.5 D

5. Meridional amblyopia

- Amblyopia occurring in patients with uncorrected astigmatic refractive error due to decreased vision in a particular spatial orientation.
- Its a selective amblyopia for a specific visual meridian.
- Occurs when a child progresses through the critical period with one visual meridian in sharper focus than the other.
- 1.25 D of astigmatism may cause amblyopia.

6. Toxic amblyopia

- It's a nutritional optic neuropathy,vision loss occur due to toxic reaction in the optic nerve.
- Several poisonous substance and nutritional factors may cause the condition.
- Example-
    - Drugs –Chloramphenicol,Ethambutol
    - Tobacco- Pipe Smokers, Excessive Smokers
    - Alcohol
    - Chemicals-Lead, Methanol

- Nutritional Disorders- Lack of Vitamin A and Zinc

CLINICAL FEATURES

1. Visual acuity is reduced

2. Effect of neutral density filter

3. Crowding phenomenon is present

4. Fixation pattern may be central or eccentric

5. Colour vision is usually normal

Symptoms

- No presenting symptoms
- Blurring of vision
- Decrease of vision
- Reduced sensitivity to contrast

Signs

- Sometimes no signs may be found in a absence of severe disease
- Rubbing of eyes
- Squinting
- Abnormal alignment of eyes
- Refractive error

COMPLICATIONS OF AMBLYOPIA

- Mainly the complication is lifelong reduction or loss of vision.
- These complications can be irreversible
- IT is caused due to decreased visual acuity, contrast sensitivity, spatial distortion, contour detection etc.
- Binocular abnormalities are also seen.
- The non-diseased eye may remain normal but the diseased eye may develop irreversible decreased vision.
- There can be difficulty is seeing in three dimensions.
- Affected children can have learning disability due to the inability to see.
- There may also be failure of strabismus due to binocular fusion dysfunction.(7)

PREVENTION

Screening tests for vision are important to identify the risk factors for amblyopia. Early diagnosis of amblyopia can be done by checking for significant refractive error . proper treatment is given immediatly. This increases the chance of preventing the disease in older

children. Best chance for treatment without complication is in younger children but adolescents can also show improvement.(8)

MANAGEMENT AND TREATMENT OF AMBLYOPIA

It can be done by:

- **Optical correction**
- **Vision Therapy**
- **Atropine penalisation**
- **Patching**
- **Pharmacological treatment**
- **Perceptual learning**
- **Modern treatment : Falling Blocks, Occlu-Pad**

Vision Therapy

Vision therapy is defined a non-surgical method to improve visual acquity. (8)

Vision Therapy is considered an active treatment where we are actively engaging weaker eye or the lazy eye to perform better, we will do activities working on its function- how that eye moves, how it tracks things, how it can focus and how it can work together with the dominant eye so the performance of the eyes is more equal. By doing this approach to amblyopia we are able to provide more lasting results.

The goal of treating amblyopia through vision therapy is to improve binocular vision that means that the two eyes must work together not one eye more dominant than the other

Other ways to treat amblyopia include atropine eye drops, better eye blurring filters, optical defocus using glasses/contact lenses, or dichoptic video games. (9)

All different types of amblyopia often require the use of visible penalisation in the non-amblyopic eye to force visible growth of the amblyopic eye. The most common method of doing this correction of the amblyopic eye. The duration for which patching is done for a non-amblyopia eye during the day varies depending on the amblyopia severity. Doctors recommend patching for two , six hours, or sometimes even full-time.

Activity such as reading, writing, TV or gaming while making patching is considered good, as the patient will be forced to use an diseased eye and may be more cooperative with treatment when associated with fun . Attachment to the non-amblyopia eye as a treatment for amblyopia dates back to the 16th century. It is still the mainstay of therapy to this day.(7)

Pharmacologic manipulation

If the patient cannot be relied upon for patching treatment, pharmacologic treatment can be more reliable. Drugs like (example atropine) can be used to block the accommodation of a non-amblyopic eye. The benefits of this treatment include the ease of putting one drop per day compared with keeping a patch on the eye for hours at a time. These treatments have been found to be effective in the same way as patching for appropriate patients. However, patients with a myopia or emmetropia in non-amblyopic eye may not benefit from pharmacologic treatment as these eyes will maintain accommodation in certain distances.(7)

Patching

It is the gold standard. Blurred vision / visual acuity compel the amblyopic eye to compress and use the visual cortex associated with the eye to restore contact for better vision. (9)

The old school way of treating Amblyopia used to be with patching (if one eye is the lazy eye we would patch the dominant eye to have the lazy eye practice looking), patching has poor compliance because many children don't want to wear the eye patch, second reason is when patient have the eye patch on they could be looking behind it or looking around it, also it doesn't promote lasting results.

The benefits of patching treatment appear to be stable within the age of 15. (8)

No. of types of patches are available to treat with occlusion therapy. General type of patch adheres to skin and patient can wear it uner his/her glasses. Soft patches are available that can fit over the spectacles of the patients. Other choice is the Bangerter foil. (10)

Traditional herbal remedies are more effectual than atropine, unless atropine is used in combination with acute eye pressure, and addition of functions seems to enhance the effect of the patching. (11)

Perceptual learning

Perceptual learning is also suggested as an adjunct to occlusion therapy. (12)

In 1963 Eleanor Gibson described Perceptual learning as working on simple visual tasks showing progress with practice in adults.

Research suggests that perpetual learning in adult amblyopic patient can increase visual activity. Better pre-test and post test performance and benefits in visual acuity have been outlined. The neural basis for this is thought to be due to the reduction of lateral repression inside the brain through training. The criticism of this perspective is that the benefits in estimates of the outcome of the amblyopic eye test do not extend to new-development conditions. Perpetual learning is still to gain widespread support.

Perpetual learning outcomes were shown to last for hours to months without continued execution, but long term follow-ups are lacking.(8)

Falling blocks

It is one of the most popular games used for treatment of any disease. It is played using the touch screen device in normal distance of the patient for reading. The patient wears a green and red spectacle with proper adjustment for the power of their eye. When the diseased eye looks at green filter, only the same coloured objects were seen by the same. The diseased eye could also could detect red objects when viewed with a red filter. Brown objects were visible to both. Parts of the treatment are introduced 100% in the diseased eye and in the lower contrast of the other eye. To be able to play the game properly, both eyes needed to be treated together. Thus, changes could be made to the one eyes to be able to complete the game. Before starting every game spell, subjects were asked to set the red-greennonius cross on the screen of the device to balance for the small angles of misalignment of eyes and ensure binocularity. In the game, participants had to turn and shift the block to the sides and fall from top of the screen to fill in the spaces left by the formerly placed blocks at base of the

screen. Falling blocks are shown in the diseased eye with full brightness, and the set blocks are shown in other eye in lower contrast. A boarder and some blocks are displayed on both the eyes to help integration of the blocks. Players gained points for each complete row of blocks, and there were separate levels of difficulty. Levels vary in the complication of the block structure and whether the blocks were required or not to rotate in the course of game play. This game do not prove to be an successful treatment to date, and supplementation has been more effective than treatment with falling blocks.(13)

Occlu-pad or occlu-tab

Occlu-pad is a device that processes pictures presented selectively in the diseased eye under open binocular. Occlu-pad uses polarized glasses and white screen technology. White-screen-technology involves stripping polarizing layer of the liquid crystal panel of i-Pad and by joining this stripped film to glass, viewing of video is only possible if patient is wearing polarized glasses. (For example), if a film is joined to right-eye lens of glasses, the subject can only see the image with right eye. (13)

The effectiveness of treatment decreases with age; recent studies points to cortical plasticity during this "critical period" and suggests that therapeutics efforts should be given to all children having amblyopia regardless of their age, together with older children. (14)

In cases where there was no upgrade after the introduction of amblyopia treatment at two to three successive visits, the result of amblyopia needs to be re-evaluated, & reconsideration of the opposition status or diagnostic review may be needed.(15-21)

If not treated, amblyopia may produce a range of practical deficits and binocular function is also compromised. The presence of amblyopia affect on educational skill, future career possibilities, self-confidence & quality of life.

CONCLUSION

Studies show that we can reverse amblyopia with correct visual stimulu,for this to happen diagnosis & treatment should begin timely. No. of studies have demonstrated that older children and adults with lazy eye also respond to the treatment. Therefore, treatment should be tried in older children.

First step in the treatment is to provide suitable refractive corrections. Patching 2 hours in a day or pharmacological penalization is considered supplementary treatment option for amblyopia. If there is no recovery seen between two successive visits, increasing the length of the adjustment period to 6 hours/day is a possibility. Proper adherence to advised amblyopia treatment is essential for significant effective result. Adherence to amblyopia treatment can be enhanced by educational programmes, direct communication with children and their parents, & increasing the follow-up visits. Treatment shall be reduced and stopped to monitor recurrence of amblyopia. Also follow-up visits are needed after discontinuation of treatment to observe any impaired vision and to provide immediate treatment, if required.

REFERENCES :

1. Park SH. Current Management of Childhood Amblyopia. Korean J Ophthalmol KJO. 2019 Dec;33(6):557–68.

2. Kapoor S. Update on Diagnosis and Management of Amblyopia. Off Sci J Delhi Ophthalmol Soc. 2019 May 9;29(4):95–7.

3. Nambudiri. Amblyopia – An update [Internet]. [cited 2021 Nov 17]. Available from: https://www.kjophthal.com/article.asp?issn=0976-6677;year=2021;volume=33;issue=1;spage=14;epage=21;aulast=Nambudiri

4. Ojiabo SN, Munsamy AJ. A review of the treatment of anisometropic amblyopia in adults using dichoptic therapy. Afr Vis Eye Health. 2020 Feb 11;79(1):9.

5. Amblyopia. Lazy eye. Vision impairment. Patient | Patient [Internet]. [cited 2021 Nov 19]. Available from: https://patient.info/doctor/amblyopia-pro

6. An Update of the Recent Developments on Amblyopia - Open Journal of Ophthalmology - SCIRP [Internet]. [cited 2021 Nov 19]. Available from: https://www.scirp.org/journal/paperabs.aspx?paperid=102466

7. Amblyopia - StatPearls - NCBI Bookshelf [Internet]. [cited 2021 Nov 19]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK430890/

8. Gopal SKS, Kelkar J, Kelkar A, Pandit A. Simplified updates on the pathophysiology and recent developments in the treatment of amblyopia: A review. Indian J Ophthalmol. 2019 Sep;67(9):1392–9.

9. Amblyopia: Types, Diagnosis, Treatment, and New Perspectives - American Academy of Ophthalmology [Internet]. [cited 2021 Nov 19]. Available from: https://www.aao.org/disease-review/amblyopia-types-diagnosis-treatment-new-perspectiv

10. OD BTH. The Generalist's Guide to Amblyopia [Internet]. [cited 2021 Nov 19]. Available from: https://www.reviewofoptometry.com/article/the-generalists-guide-to-amblyopia

11. Li Y, Sun H, Zhu X, Su Y, Yu T, Wu X, et al. Efficacy of interventions for amblyopia: a systematic review and network meta-analysis. BMC Ophthalmol. 2020 May 25;20(1):203.

12. 7th Edition Comprehensive Ophthalmology by AK Khurana

13. (PDF) Current Management of Amblyopia with New Technologies for Binocular Treatment [Internet]. [Cited 2021 Nov 19]. Available from: https://www.researchgate.net/publication/352318657_Current_Management_of_Amblyopia_with_New_Technologies_for_Binocular_Treatment

14. Papageorgiou E, Asproudis I, Maconachie G, Tsironi EE, Gottlob I. The treatment of amblyopia: current practice and emerging trends. Graefes Arch Clin Exp Ophthalmol. 2019 Jun 1;257(6):1061–78.

15. Saxena R, Sharma P, Gopal S. National consensus statement regarding pediatric eye examination, refraction, and amblyopia management. Indian J Ophthalmol. 2020 Feb;68(2):325–32.

16. Gajbhiye, Varsha, and Yeshwant Lamture. “Minoxidil a Youth Elixir for Eyebrow Hypotrichosis.” JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH 14, no. 2 (February 2020). https://doi.org/10.7860/JCDR/2020/42801.13474.
17. Kedia, Palak, and Bhushan Madke. “Unilateral Molluscum Contagiosum Following Eyebrow Grooming.” JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH 13, no. 11 (November 2019): WD01–2. https://doi.org/10.7860/JCDR/2019/42600.13283.
18. Khasbage, Suwarna Dangore, and Arvind S. Bhake. “Cervical Lymphadenopathy in a Dental Patient: An Eye Opener Case Report.” SPECIAL CARE IN DENTISTRY 39, no. 1 (February 2019): 59–64. https://doi.org/10.1111/scd.12336.
19. Khasbage, Suwarna Dangore, and Arvind S. Bhake. “Cervical Lymphadenopathy in a Dental Patient: An Eye Opener Case Report.” SPECIAL CARE IN DENTISTRY 39, no. 1 (February 2019): 59–64. https://doi.org/10.1111/scd.12336.
20. Laad, Gaurish, Bhushan Madke, and Balkrishna Nikam. “Cirsoid Aneurysm of Upper Eyelid.” JOURNAL OF DERMATOLOGY DERMATOLOGIC SURGERY-JDDS 23, no. 2 (December 2019): 109–10. https://doi.org/10.4103/jdds.jdds_30_19.
21. Mahatme KG, Deshmukh P, Sable P, Chakole V. Ultrasonography: The Third Eye of Anaesthesiologist. JOURNAL OF PHARMACEUTICAL RESEARCH INTERNATIONAL. 2021;33(37A):235–8.