Case Report

Low Vision Assessment and Management of a Leukemia Patient Undergoing Chemotherapy: Everybody Deserves Good Functional Vision

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Abstract

Background: Acute myeloid leukemia (AML) is a malignant disorder of the hematopoietic stem cells characterized by abnormal proliferation of myeloid blast cells in the bone marrow and blood, preventing them from further differentiating into the specialized cells of the bone marrow and thus causing pancytopenia. Consequently, AML can affect various tissues and organs (liver, skin, central nervous system), including the eye and orbit. Ophthalmic manifestations of leukemia are more frequent with acute than chronic leukemia. It can affect all intraocular structures.

Methods: We present a 17 year old male student with AML, who developed severe painless progressive reduction of vision. Visual acuity (VA) was found to be Hand Movement (HM) in both eyes. Patient's ocular B-scan showed every other ocular structure to be normal except the retina and vitreous. They showed some areas of tumor deposit and some atrophic areas. Patient was counseled on reason for reduction in vision and referred to the optometry clinic for expert management. Patient was referred to Low Vision unit for low vision assessment as there was no improvement after refraction.

Results: There was a great improvement from HM to 6/5 after assessment, training and prescription of low vision aids.

Conclusions: Hope was restored when low vision aids were prescribed. Everybody deserves functional vision notwithstanding life expectancy as long there's life.

Keywords: Leukemia, low vision, functional vision, visual aids

Introduction

Leukemia starts when the DNA of a single cell in the bone marrow changes (mutates) and cannot develop and function normally.[1,2] Leukemia cells often behave like abnormal white blood cells. Leukemia starts in the soft, inner part of the bones (bone marrow), but often moves quickly into the blood. Leukemia can then spread to other parts of the body, such as the lymph nodes, spleen, liver, central nervous system and other organs.

Acute myeloid leukemia (AML) is a malignant disorder of the hematopoietic stem cells characterized by abnormal proliferation of myeloid blast cells in the bone marrow and blood, preventing them from further differentiating into the specialized cells of the bone marrow and thus causing pancytopenia.[3]AML can affect various tissues and organs (liver, skin, central nervous system), including the eye and orbit. This type of cancer usually gets worse quickly if it is not treated and the leukemia cells continue to multiply as a result of mutation or coding error.

In AML, the myeloid stem cells usually become a type of immature white blood cell called myeloblasts (or myeloid blasts). The myeloblasts in AML are abnormal and do not become healthy white blood cells. Leukemia cells can build up in the bone marrow and blood until there is less room for healthy white blood cells, red blood cells, and platelets. When this happens, infection, anemia, or easy bleeding may occur.[3,4]

Frequency of ophthalmic manifestations of leukemia are more with acute than chronic leukemia and can affect all intraocular structures.[5,6] The reported prevalence of ocular involvement with acute leukemia ranges from 32% to 35.5%.[1,7,8] Ophthalmic manifestations are caused by direct neoplastic cell infiltration or indirect complications secondary to hematologic abnormalities (thrombocytopenia, anemia and hyper-viscosity state). In addition, ophthalmic involvement can be the initial manifestation of the systemic disease or the first sign of relapse.[4]

The risk factors of AML include; older age, smoking, having had treatment with chemotherapy or radiation therapy in the past, being exposed to radiation in the environment (such as nuclear radiation) or to the chemical benzene, having a personal history of a blood disorder such as myelodysplastic syndrome and having

certain syndromes or inherited disorders. [9] The early signs and symptoms of AML include fever, feeling tired, and easy bruising or bleeding, infections and paleness or loss of normal skin color. The symptoms may develop between 4 and 6 weeks before diagnosis.[9]

Tests that examine the blood and bone marrow and used to diagnose AML include; health history, physical examination and Complete Blood Count (CBC). The normal ranges for CBC are; red blood cells (male 4.35 - 5.63 trillion cell/L and female 3.92 - 5.13 trillion cell/L), white blood cells (3.4 - 9.6 cell/L), and platelets (Male 135 - 317 billion/L, female: 157 - 371 billion/L) and Hemoglobin (male: 13.2 -16.6 grams/dL, female: 11.6 - 15 grams/dL) in the red blood cells. Lumber puncture and CT scan (CAT scan) are tests done to check for the spread of cancer. [2]

The treatment options include: Chemotherapy/Radiation therapy, Chemotherapy with stem cell transplant, supportive care for side effects of treatment (transfusions, antibiotics and antifungals), targeted therapy using drugs (midostaurin, monoclonal antibodies, etc) for a particular cancer cell and other drug therapies. [7,8,10]

Low vision is a condition in which a person has visual impairments even after medical treatment or standard refractive correction and has a visual activity of less than 6/18 to light perception, or a visual field of less than 10^0 from point of fixation but who used to be or is potentially able to use vision from planning and execution of task.[11]

About 285 million people in the world are visually impaired from various causes and of these, 39 million people are blind and 246 million have low vision. The main cause of moderate and severe visual impairments is uncorrected refractive error, whereas cataract remains the leading cause of blindness in middle and low-income countries, while 80% of all visual impairments can be prevented or cured.[12]

The major causes of blindness are cataract (50%), glaucoma (16%), corneal opacity due to trachoma, trauma, vitamin A deficiency and other infections (12%), optic atrophy (3%) refractive error (1%), macular degeneration (<1%) and others (18%). On the overall, two out of every three cases of blindness in Nigeria can be avoided.[13]

Case Presentation

A 17year old male patient with a case of acute myeloid leukemia (AML) presented to the General Outpatient Department (GOPD)

of Aminu Kano Teaching Hospital Kano, Nigeria with the complaint of fever for 2 weeks and gum bleeding. On further investigation the patient was found to have acute myeloid leukemia. By the time of presentation to the eye clinic, he had undergone the first round of induction cytotoxic chemotherapy. The patient experienced frequent depletion of vision and reduction in visual acuity (VA) from 6/6 to 6/60 within a week which informed the referral of the patient to the ophthalmology clinic for expert evaluation. On examination, it was found that the patient had developed severe painless progressive reduction of vision and VA was found to be HM in both eyes. During external examination with pen torch, everything was found to be normal, but fundoscopy showed there was no fundus reflex which hindered the visibility of the fundus. Patient was recommended for Ocular B- Scan which showed every other ocular structure to be normal except the retina and vitreous which showed some areas of tumor deposit and some atrophic areas. The patient was counseled on reason for reduction in vision and referred to the optometry clinic for expert management. On presentation to the optometry clinic, VA was found to be 4/60 OD and 3/60 OS (eccentric), no improvement with pin hole on the OS and Improvement to 6/60 on OD, near VA was N24.

Retinoscopic findings:

OD; + 1.00/ - 2.25^{0} X180

0S; No reflex

Subjective refraction;

OD; + 0.50/ - 0.50 X180 6/36

0S; no reflex

He was referred for Low Vision Assessment in our Low Vision Unit using LogMAR chart at 4 meters.

VA at far: OD; 0.9 logMAR (6/48)

OS; 1.06 logMAR

VA at near: OD; 1.25m @ 15cm

OS; 6.7m @ 14cm

Contrast Sensitivity (CS) using Lea flip low contrast chart optotypes.

OD; 3/25 at 1 meter

4/25 at 0.75meter

5/25 at 0.50meter

OS; 3/25 at 1 meter

4/25 at 0.75meter

5/25 at 0.50meter

CS was reduced

Upon low vision calculation with best seeing eye (OD) for both far and near.

Magnification = Actual /Desire

Distance = 48/5 = 9.6X

Near = 1.26/0.6 = 2.08X

Equivalent Viewing Distance (EVD) = Eye to image distance / Enlargement ratio

EVD = 15/2 = 7.5cm

Equivalent Viewing Distance (EVP) = 1/ EVD = 1m/7.5cm = 100cm/7.5cm = 13.3D = 13D

Patient was trained using 8x telescope and was able to read 6/9.5 (OD), 2X Magnifier (Hand Held) to read 0.63 or N5.

On Second training session, he was trained with 10X and he was able to read 6/5 (VA)

In all the follow-up for training the VA remained the same.

Recommendations:

1. 10X monocular telescope was recommended for the patient to read 6/5.
2. 2X Hand Held Magnifier to read N5 with the OD.
3. 8.00D / -0.50 X 180 spectacle magnifier to read N5 which also improve the reading distance from 7.5 cm to 13.9cm.
4. Continue with ongoing management with the Day Care Unit.

Conclusion

Hope was restored when low vision aids were prescribed. Everybody deserves functional vision notwithstanding life expectancy and condition, as long as there is life. The patient was happy and went back to school with a cheerful face. People with visual impairment need Low Vision Aids to enable them achieve their aims and fulfill purpose for the time being and be happy.

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