

# Cerebral Polyopia Following Treatment with Chemotherapy for Breast Cancer

*Thuraya N. Maher<sup>1</sup>*

## Abstract

Diplopia /polyopia of cerebral origin is an infrequent encounter in neuro- ophthalmic practice. Its origin is not exactly known, but it is believed to be secondary to bilateral occipital lobe lesions, commonly infarction. Chemotherapy is well documented to cause neuronal damage. Most patients develop manifestations of cognitive and CNS complications during treatment or shortly afterwards. However, delayed CNS damage may also occur; the precise pathophysiology under this is not known. A recent research suggested that chemotherapy causes demyelination of the deep white matter in the cerebrum which may explain the delayed and/ or long term neurological deficit . We report a case of cerebral polyopia in a 56 year old female who was treated with chemotherapy , in addition to radiotherapy and hormonal therapy, seven years before developing polyopia. Her MRI showed degenerative lesions of the deep white matter consistent with demyelination.

**Keywords:** cerebral polyopia, breast cancer, chemotherapy.

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## Introduction

Cerebral polyopia presents as seeing many images of an object in variable arrangement and clarity after fixation on a stimulus. The polyopic images are typically present in monocular fixation bilaterally (with either eye open) and also binocularly differentiating it from ocular polyopia which results from distortion of light transmission to the retina by an eye pathology such as a refractive error or cataract. Cerebral polyopia localizes the pathology to the cerebrum (as its name implies) and most commonly follows vascular accidents,

or degenerative brain diseases.

We describe a case of cerebral polyopia following treatment with chemotherapy for breast cancer.

## Case report:

A 56 year old non- hypertensive, non-diabetic woman presented in June/ 2017 complaining of seeing duplicated images for one month. She first noticed it in the waiting room of a hospital where she attended regular check up following treatment of breast cancer. She noticed that objects at about 4 meters distance appeared with two shadows. This

1 Ophthalmology Unit, Al- Madar Medical Centre, United Arab Emirates, Sharjah.

\* Correspondence should be addressed to:

Thuraya Noaman Maher

Ophthalmology Unit, Al- Madar Medical Centre, United Arab Emirates, Sharjah

Email: thurayamaher@rocketmail.com

occurred while both eyes were open and also when she closed one eye. It lasted for few minutes, disappeared spontaneously to reappear after few seconds. The duplicated images were faint and horizontal but vertical images also appeared in between. The condition then recurred frequently and was experienced mostly while watching TV or working at the computer. Otherwise, she was often able to ignore it though aware of its presence. This was not associated with headache or any physical complaint. Her past medical history revealed that she was treated from a left breast cancer with radio-chemotherapy in 2010. Following a modified radical mastectomy, she received cyclophosphamide, epirubicin and 5 fluorouracil. She also received Femora for 5 years which was stopped in 2015. At presentation, she was not on any regular medications.

Her ophthalmic examination revealed unaided distant visual acuity of 20/20 in both eyes. The optotypes on one side of the screen (patient's left field of vision) appeared triple for approximately two minutes, the duplicated images changed in clarity over time and disappeared spontaneously or when the head was turned to one side or the other and reappeared after few seconds. They were mostly horizontal, but vertical images also appeared momentarily. Different objects were presented to the patient at different distances; the polyopia was present at a distance of 4-6 meters and appeared with the characterization above. Troubled by it, the patient would close her eyes to terminate it. The polyopia was much less evident when near vision was examined.

Both dynamic and cycloplegic refraction were normal. She was orthophoric with intact ocular motility. Her pupils reacted normally to light and there was no afferent pupillary defect.

Stereovision, slitlamp examination and funduscopy were all normal.

Visual field test was normal. MRI was done to rule out secondary metastasis to the orbit or brain. The brain MRI showed small hyperintense lesions in the deep white matter of both cerebral hemispheres with no enhancement in post-contrast study, suggestive of white matter degenerative changes. No orbit or brain metastasis was detected. Figures 1-6

### Discussion:

Diplopia or polyopia of cerebral origin is infrequently encountered in neuro-ophthalmic practice. Review of literature showed that cerebral diplopia or polyopia may vary in presentation from case to case. It is reported to appear as (a) full or partial second image(s) of the real object which varies in clarity from a faint shadow to looking real and clear. It may also appear with a very complex multiplication of images. In some cases, the second images appeared few seconds after gazing at an object, multiplied suddenly, changed position within the visual field or became less distinct within seconds to a few minutes before they disappeared.<sup>1-4</sup> An accompanying defect in the visual field was present in some cases and sometimes lasted for longer than the polyopia.<sup>1,4</sup>

The mechanism of cerebral diplopia and polyopia is not clearly understood because of the rarity of the condition; however, it is largely attributed to occipital lesion(s) that are usually bilateral.<sup>1</sup>

Bender speculated that fixation instability secondary to occipital lobe disease would lead to repeated ocular excursions at a rapid rate resulting in competing 'maculae.' This rivalry (or competition) ends up in transmission of conflicting visual information.<sup>2</sup> Other

researchers described evidence that structures exist in the occipital lobe which are functionally connected to different points in the visual field.<sup>5,6</sup>

Adverse neurological effects have been observed with almost all categories of chemotherapeutic agents.<sup>7-9</sup> Chemotherapy frequently results in various neurological deficits and / or cognitive dysfunction which usually appear during treatment or shortly after cessation and it is also known to have an impact on the long term neuropsychological health of breast cancer survivors.<sup>10-15</sup>

White matter lesions occur in breast cancer patients treated with chemotherapy; the precise pathophysiology under this is not known. Recently, Han et al. provided an animal model of delayed damage to white-matter tracts of individuals treated with systemic chemotherapy and suggested that it represented a new class of delayed degenerative damage in the CNS secondary to systemic chemotherapy.<sup>16</sup>

Our patient presented seven years after chemotherapy with polyopia consistent with that of cerebral origin being present with binocular and monocular vision in either eye, and only objects in one field of vision at a certain distance from the eye appeared duplicated. Our case is similar to what was described by Safran et al with polyopia being stimulated by gazing at TV (and computer

monitor).<sup>1</sup>

The polyopia described in this report also bears similarity to what was described separately by Meadows and Safran et al as it developed within seconds of fixation.<sup>1,4</sup>

Our case differs from other reported cases of cerebral diplopia (polyopia) in being isolated i.e. not associated with a filed defect.

Her MRI showed degenerative deep white matter lesions involving the parietal area bilaterally, these lesions are mostly caused by chemotherapy. Since there was no enhancement of the hyperintense lesions, the radiologist who interpreted the MRI result excluded multiple sclerosis as a cause of the degeneration because MS lesions are usually of different duration and the old ones do enhance. In this, our case also differs from other reported cases of cerebral polyopia that we came across while reviewing the literature as the majority were due to infarction of the occipital cortex. Figure 1

To our knowledge, this is the first case of cerebral polyopia that may be secondary to degenerative damage of the white matter of cerebral hemispheres due to treatment with chemotherapeutic agents.

#### **Conclusion:**

Cerebral polyopia can occur years after treatment with chemotherapy possibly due to a degenerative process in the brain.

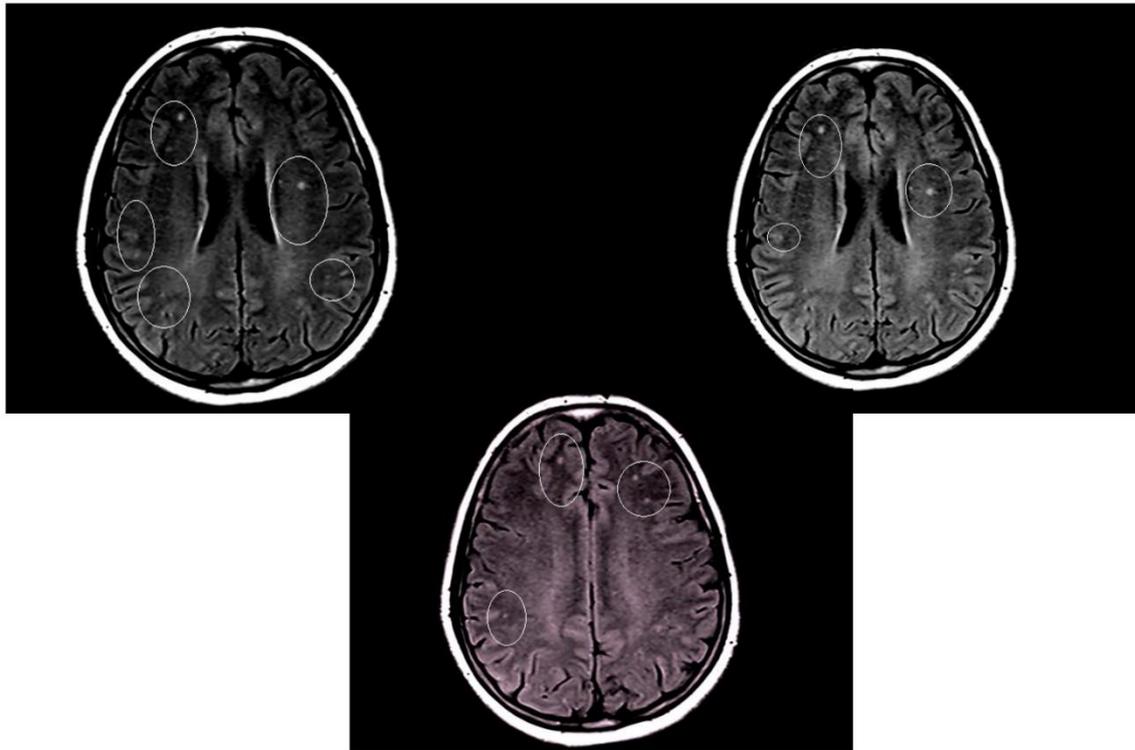


Figure 1

Legend for Figure 1

#### Brain Axial Section FLAIR Weighted - Image Sequences

Small focal hyper intense lesions (encircled) are detected at T2 and FLAIR WI in deep white matter of both cerebral hemispheres. Signs of white matter degenerative/ small vessel ischaemic changes.

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## تضاعف الرؤية ( الشَّقَع ) الدِّماغِيّ إثر المعالجة الكيمايَّة لحالة مصابة بسرطان الثدي

### تقرير حالة

ثريا نعمان ماهر

1. استشاري طبّ العيون وجراحاتها، مركز المدار الطَّيِّ، الشارقة، الإمارات العربيَّة المتَّحدة

### الملخص

تضاعف الرؤية (الشَّقَع) الدِّماغِيّ حالة نادرة الحدوث غير معروفة السَّبب على وجه الدقَّة، قد تكون ناتجة عن علة في فصّي الدماغ القفويّين كالاكتشاء. من المعروف أنّ المعالجة الكيمايَّة تؤدّي إلى تلف عصبيّ غالباً ما يكون على شكل تراجع في الإدراك ومضاعفات عصبيّة تظهر خلال العلاج أو بعده بوقت قصير. كما يمكن أن يحدث التَّلَف العصبيّ لاحقاً بعد مرور وقت طويل على المعالجة الكيمايَّة. تقترح إحدى الدِّراسات الحديثة أنّ المعالجة الكيمايَّة تسبّب إزالة طبقة الميالين من المادّة البيضاء العميقة في الدماغ ويستغرق ذلك وقتاً طويلاً فيتأخَّر ظهور الأعراض.

هذا تقرير حالة عن مريضة تبلغ من العمر ستة وخمسين عاماً كانت قد عولجت كيمايَّاً و إشعاعيَّاً وهورمونياً من سرطان الثدي وأصيبت بالشَّقَع الدِّماغِيّ بعد العلاج بسبع سنوات. أظهر فحص الرنين المغناطيسيّ وجود آفات تنكسيّة في المادّة البيضاء العميقة في الدماغ.

الكلمات الدالَّة: تضاعف الرؤية ( الشَّقَع ) الدِّماغِيّ، سرطان الثدي، المعالجة الكيمايَّة.