ORIGINAL ARTICLES

VISUAL IMPAIRMENT IN GHANAIAN PATIENTS WITH BRAIN TUMOURS, FACTORS AFFECTING THIS AND THEIR PROGNOSTIC SIGNIFICANCE

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Abstract

Background: Anecdotally, Ghanaians with brain tumours present late with visual impairment. Contributory factors are unclear.

Purpose: To determine the degree of visual impairment in Ghanaians with brain tumours, factors affecting this and their prognostic significance.

***Methods*:** A prospective study of 70 consecutive patients newly diagnosed with brain tumours seen from November 2010 to July 2013, at Korle-Bu Teaching Hospital(KBTH), Accra, Ghana. Patients had clinical diagnosis of brain tumour with confirmation by Computerized tomography(CT) or Magnetic Resonance Imaging(MRI).

Outcome measures: presenting visual acuity, pre-presentation symptom interval (PPSI), tumour size and location at presentation.

***Results*:** Data on 70 patients was analyzed. Ages ranged from 8 days to 70 years, mean(SD) 41.8±1.8. Forty-seven (67.1%) were females. Histology was confirmed in 22(75.9%) of 29 who had surgery, comprising: pituitary adenoma, 17(77.3%) meningioma, 2(9.1%) craniopharyngioma, 2(9.1%) and combined pituitary adenoma and meningioma,1(4.5%). Common presenting symptoms were blurred vision, 65(92.9%), headache, 51(72.9%) and ocular pain, 22(31.4%).

Common signs were impaired colour vision in 97(79.5%) of 122 eyes and optic atrophy in 49(35%) of 140 eyes. Fourteen (20%) patients were visually impaired and 18(25.7%) blind. Visual impairment 20(14.3%) and blindness, 61(43.6%) were present in 140 eyes.

Pre-presentation symptom interval(PPSI) was longer in the blind than the visually impaired. However, no significant association was found between PPSI and visual impairment or blindness (p=0.660). No association was found between diagnosis and visual status at presentation (p=0.629)

Conclusions: Early detection of brain tumours to avoid blindness and visual impairment is needed in this population since majority (57.9%) of eyes were blind or visually impaired at presentation.

Key Words: brain tumour, visual impairment, blindness, optic atrophy, Ghana.

Introduction

Half of all patients with brain tumours may first present to the ophthalmologist with ophthalmic signs and/or symptoms[1, 2]. Visual symptoms are commoner in suprasellar tumours which comprise 25% of tumours in the chiasmal region[1]. Pituitary tumour (50%), craniopharyngioma (25%) and meningioma (10%) are the three most common tumours in this region[1, 3].

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Anecdotal data at the Korle Bu Teaching Hospital (KBTH) showed that a number of patients with brain tumours presented late with visual impairment or blindness. This study therefore purposed to determine the prevalence of visual impairment in Ghanaian patients with brain tumours presenting to the KBTH, factors affecting this and their prognostic significance. This may provide the basis for advocacy for early detection of brain tumours in Ghana.

Methodology

This is a prospective case series involving 70 consecutive patients newly diagnosed with brain tumour seen from November 2010 to July 2013 at the Ophthalmology Department of the KBTH. Only those who consented to participate in the study through

informed consent were included. Patients and carers who did not consent to participation were excluded from the study. Ethical approval was obtained from the Ethical and Protocol Review Committee of the University of Ghana School of Medicine and Dentistry.

All patients had neurological, endocrine and ophthalmic examinations and confirmation of diagnosis of brain tumour was by computerised tomography (CT) or magnetic resonance imaging (MRI). Demographic *(*age, sex, community of residence*)*, clinical (symptoms, ophthalmic,endocrine,neurologic) and histopathological data were recorded using a predesigned questionnaire.

Ophthalmic Evaluation

Visual acuity (VA) testing was done using appropriate test type for age: Fixing and following objects in infants, Cardiff charts for ages 3 months to 2 years, matching tests such as Kay pictures and Sheridan-Gardner charts for children aged 3 to 5 years and Snellen's chart for children over 5 years and adults. Illiterate patients had visual acuity testing using the tumbling E optotypes. The following test sequence was used for patients who were unable to see letters at the closest test distance: count fingers (CF) at 1 m, hand movement (HM) at 1 m, light perception (LP) and no light perception (NLP). Best Corrected Visual Acuity with spectacles (BCVA) was recorded using WHO categories of visual impairment adapted from the International Classification of Diseases (9th revision, 1975). [4] Visual status was graded as:

(a) 'Blind' when visual acuity (VA) was < 3/60–1/60 (equivalent to CF at 1 m, LP and NLP),

(b) 'Impaired' when VA was <6/18–3/60

(c) 'Normal' when VA was 6/6–6/18.

Colour vision was tested using Ishihara Colour Vision Charts (38 Plate Edition 1994).

External eye examinations included evaluation for proptosis using Hertel's exophthalmometer (G.Rodenstock Instrument; Munchen Hamburg, Germany), assessment of ocular movements, diplopia and nystagmus. Anterior segment assessment included slit lamp examination using (Topcon ATE-600 serial number 800175, 2004, Germany) as well as pupil reaction to light and relative afferent pupillary defect (RAPD). Fundus examination was done using biomicroscopy with a + 90D lens, indirect ophthalmoscope with +20D/ +28D lenses and direct ophthalmoscope through dilated pupils (using tropicamide 1%, and or cyclopentolate eye drops 1% with phenylephrine 2.5% eye drops). Visual field was assessed using a Humphrey visual field analyser (SITA, Carl Zeiss Meditec; Dublin CA.USA, 2005).

Tumour size was assessed radiologically using Computerised Tomography scan (CT scan) Hitachi Eclos -2009 or Magnetic resonance imaging (MRI) Hitachi Airis elite (OPEN)

Endocrine Evaluation*:*

All patients were examined by the endocrinologist on the study team and an assay of anterior pituitary hormones was performed. Hormones assayed included leutinizing hormone(LH), follicle stimulating hormone(FSH), 9am serum cortisol, prolactin (PRL), triiodothyronine (free T3), thyroxin(free T4), and thyroid stimulating hormone(TSH)

Neurosurgical Evaluation

Neurosurgical evaluation by the neurosurgeons included history and examination of the nervous system. The mental state, cranial nerves, coordination, motor and sensory examinations were performed on each patient.

Outcome measures

Primary outcome measures studied were visual acuity at presentation and pre-presentation symptom interval (PPSI).

Secondary outcome measures were tumour size at presentation, tumour location at presentation and type of visual field defect at presentation.

Statistical Data Analysis

Data was captured using Microsoft Access and analysed using Statistical Package for Social Scientists (SPSS) Version 16.0. Categorical data were summarized as percentages (%) and continuous numeric data as Mean and Standard deviation (SD). Results were presented as frequencies, tables and charts. To prove significant outcomes, t-test was used to compare mean levels of visual acuity between right and left eyes. Mann-Whitney Test was used for establishing significant association between, duration before presentation and, visual acuity, optic atrophy and RAPD. Chi-squared test was used to compare proportions, at 0.05 significant levels.

Results

All 70 patients referred to the Ophthalmology Department with a diagnosis of intracranial tumours from November 2010 to July 2013 were recruited and their data analysed. Patients' ages ranged from 8 days to 70 years, mean of 41.8 years with a standard deviation of 1.8 years. Forty-seven (67.1%) were females and 23 (32.9%) males (female: male ratio of 2:1).

The commonest tumour types by neuro imaging diagnosis encountered were pituitary adenomas 44 (62.9%) and meningiomas 12 (17.1%). Other tumour types are shown in Table 1. Twenty-nine (41.4%) out of the 70 patients had surgery (Figure 1) and histology was confirmed in 22 (75.9%) of those who had surgery. The histological diagnoses comprised: pituitary adenoma,17(77.3%)meningioma,2(9.1%) craniopharyngioma, 2(9.1%) and one patient (4.5%) who had both frontal meningioma and pituitary adenoma.

The majority of tumours, 56 (80%), were in the parasellar and thalamic region. There were 5(7.1%) each in the frontal and tempo-parietal regions and 4(5.7%) in the posterior fossa.

The pre-presentation symptom interval (PPSI) was 18.5 ± 25.7 months [range of 1 day to 10 years, median of 7 months]

Table1. Neuro-imaging diagnosis of brain tumours

Tumour type	Frequency	Percent
Pituitary adenoma	44	62.9
Meningioma	12	17.1
Haemangioblastoma	3	4.3
Acoustic neuroma	2	2.9
Craniopharyngioma	2	2.9
Choroid plexus tumour	1	1.4
High grade glioma	1	1.4
Medulloblastoma	1	1.4
Cancer of the breast (metastases)	1	1.4
Pilocytic astrocytoma	1	1.4
Brain stem glioma	1	1.4
Thalamic tumour	1	1.4
Total	70	100.0

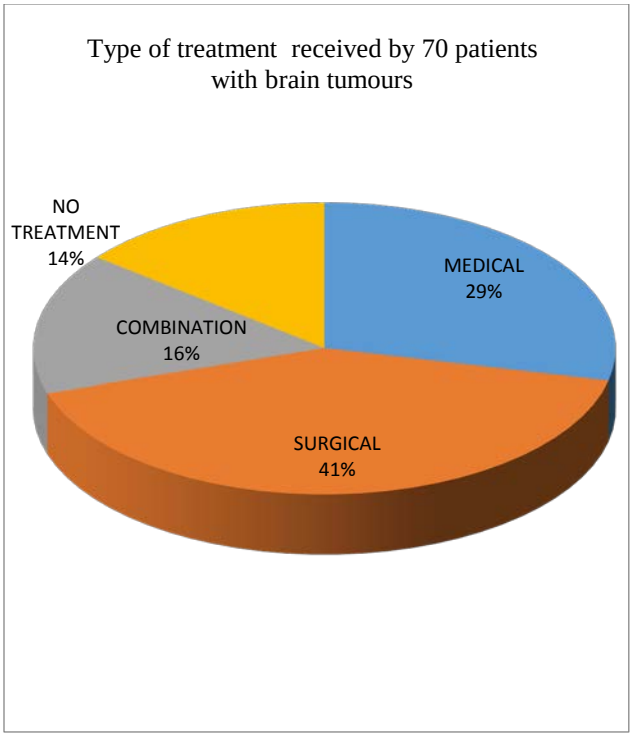

Fig 1: Type of treatments received by 70 patients diagnosed with brain tumours

. Sixty-five (92.9%) of the 70 patients seen complained of blurred vision, bilateral in 42 (60%) of them. Other common non- ocular symptom reported was headache 51(72.9%). Other symptoms are shown in Table 2.

The commonest neuro-ophthalmic signs seen were impaired colour vision in 79.5% of eyes and bilateral optic atrophy in 51.4% of patients. Other signs are shown in Table 3

Table 2. Ocular and non-ocular symptoms in 70 patients with brain tumours

Symptoms	Number (%)
Ocular	
Visual blur	65(92.9)
Ocular pain	22(31.4)
Diplopia	8(11.4)
Non – ocular	
Headaches	51 (72.9)
Seizure	7(10.0)
Galactorrhoea	9(12.9)
Irregular menses	10(14.3)
Amenorrhea	11(15.7)

Table 3. Ocular and non-ocular signs in 70 patients with brain tumours

Signs	Number (%)
Ocular	
Proptosis	6(8.6)
Red eye	6(8.6)
Unilateral disc swelling	3(4.3)
Bilateral disc swelling	9(12.9)
Unilateral optic atrophy	13(18.6)
Bilateral optic atrophy	36(51.4)
Nystagmus	1(1.4)
Ptosis	2(2.9)
RAPD	20(28.6)
Impaired colour vision	97(79.5%)
Non - ocular	
Cranial nerve III, IV, VI paresis	1(1.4)
Cranial VI paresis	2(2.9)

Tumour volume was assessed in 29 of the 70 patients examined and this ranged from 0.33cm^3 to 266cm^3 with an average of 41.7cm^3 ±6.0.

Blindness and visual impairment at presentation

Thirty eight (54.3%) of the 70 patients had normal vision (Table 4). Four (5.7 %) patients had visual acuity of No Perception of Light (NPL) in both eyes at presentation. Considering monocular blindness, 61(43.6%) eyes were blind in either eye. Eighty-nine (63.6%) of the 140 eyes examined were either visually impaired or blind (Table 4). There was however no significant difference in the level of visual impairment or blindness in the right or left eye (p=0.092). Though patients with long PPSI were more likely to present blind than visually impaired (Table 5) there was no significant association found between PPSI and level of visual acuity (p=0.660). No significant association was found between visual status at presentation and neuro-imaging diagnosis, (p=0.629) tumour location (p=0.227) or tumour volume. (p=0.595)

Table 4. Unilateral and bilateral visual status of patients diagnosed with brain tumours.

Visual status	Right Eye	Left Eye	Total Eyes	Bilateral
	No. (%)	No. (%)	No. (%)	No. (%)
Normal	28(40.0)	23(32.9)	51(36.4)	38(54.3)
Visual Impair-ment	10(14.318)	(25.7)	28(20.0)	14(20.0)
Blind	32(45.7)	29(41.4)	61(43.6)	18(25.7)
Total	70(100.0)	70(100.0)	140(100.0)	70(100.0)

Table 5. Prepresentation symptom interval (PPSI) by visual status

Visual Status	Pre Presentation Symptom Interval(PPSI), months				
Number (%)	0-6	7-12	13-18	19-24	Total
Normal	22(52.4)	7(16.7)	4(9.5)	9(21.4)	42(100)
Visually impaired	7(70.0)	1(10.0)	1(10)	1(10.0)	10(100)
Blind	6(33.3)	5(27.8)	2(11.1)	5(27.8)	18(100)
Total	35(50.0)	13(18.6	7(10.0)	15(21.4)	70(100)

Predicting mortality was difficult because there were only two deaths. Both deaths were in patients who had large frontal meningiomas.

Discussion

Intracranial tumours are among the leading causes of morbidity and mortality in patients suffering from neurological disease[5]. In developing countries, severe visual impairment and blindness from optic atrophy have been attributed to late presentation of such tumours[2,5]. In this series of 70 patients, 92.9% reported blurred vision at presentation. This is similar to other studies [3, 5, 7].

Blurred vision, one of the commonest presenting symptoms in any eye clinic, is a symptom shared by many other eye diseases[7]. Some ophthalmologists might misdiagnose the cause of the blurred vision and try to treat it inappropriately, thus delaying further investigations to rule out optic nerve or chiasm compression from intracranial tumours. This may then lead to axon damage or even blindness[7].

The male to female ratio in this study was 1:2. This corroborates findings from Thailand and Australia[5,8] but in contrast with other studies[6,9] from Nigeria, which shares similar geographical and socio-economic factors with Ghana. The higher proportion of females in our series may be reflective of more of the tumours encountered being pituitary adenomas as opposed to meningioma seen in both studies from Nigeria.

This current study demonstrated a wide PPSI (1 day to 10 years, median 7 months). This wide variability in symptom interval is similarly evidenced in a South-Western Nigerian study[6]. In this Ghanaian study, though patients with long PPSI were found to be more likely to present blind than visually impaired, there was statistically no significant association found between PPSI and level of visual acuity (p=0.570). Studies have indicated however, that patients with longer duration of symptoms had less recovery of vision[3].

Twenty percent of patients in this study were binocularly blind and 25.7% were visually impaired at presentation. The number of bilateral blindness is similar to a Kenyan study of 60 patients which found 18% bilaterally blind[2]. However,the proportion of bilateral blindness in this current study is lower than that found in a series of 88 patients in South-Western Nigeria which reported bilateral blindness of 52%[6]. Considering monocular blindness and visual impairment however, majority (63.6%) of the 140 eyes examined were either blind (43.6%) or visually impaired (20%). This high number of blind patients is similar to a study in Saudi Arabia[10]. However, this finding is higher than that seen in Ile Ife, Nigeria in which 3.4% patients were unilaterally blind and 6.8% visually impaired[6]. This disparity may be related to the difference in the pattern of brain tumours studied; parasellar tumors (pituitary adenoma, meningioma and craniopharyngioma) constituted 55.6% of all brain tumours studied in Ile Ife, Nigeria as compared to 80% in the present study. The anatomical location of these parasellar tumours predisposes them to higher frequency of mass-compression effect on the optic nerve, optic chiasma and optic tract with resultant visual impairment and blindness[6]. There was however no significant difference in the level of visual impairment or blindness in the right or left eye (p=0.092). This may be explained by symmetrical involvement of right and left eyes in this study, confirmed by 10 cases each of RAPD in right and left eyes.

Pituitary adenomas (62.9%) and meningiomas (17.1%) were the most common tumours in this series as was the case in some series[3,7], but this is in contrast with other studies which reported meningioma as the commonest[5,6,8,11,12,13]. This difference is difficult to explain.

Majority (80%) of tumours in the current study, were in the parasellar and thalamic region. Tumours in the parasellar region, cause visual impairment and blindness by compression of the optic nerves and chiasm due to their close proximity to these structures[2,3,7,11]. Interestingly, there was no correlation found between tumour location and visual status(p=0.227) in this study, a finding that contrasts with that from a Kenyan study which found statistically significant correlation between tumours compressing the anterior pathway (frontal, suprasellar) and degree of visual impairment[2]. This difference in findings between the two studies may be due to a difference in the pattern of the tumours in the two studies. Other studies on suprasellar tumours did not test association between tumour location and degree of visual impairment[3,5,7].

There was no correlation found between tumour volume and visual status in this study. (p=0.595) This contrasts findings from Saudi Arabia[10]. This difference may be as a result of tumour volume being assessed in only a few of the patients. Mean tumour size has been

found to be greater in the blind than the non-blind and loss of vision found to be significantly related to tumour size, as well as perifocal oedema in a study from Ibadan[14]. Our study however, did not establish this relationship.

Conclusion and recommendations

Early detection of brain tumours to avoid blindness and visual impairment is needed in this population since majority (57.9%) of eyes were blind or visually impaired at presentation. We therefore recommend education of the public and health care providers to ensure prompt diagnosis and referral.

Strengths and Limitations

The main strengths of this study included its prospective nature which aided proper documentation of clinical signs. However, the lack of histological diagnosis and the two dimensional measurement of tumour size which posed a challenge on tumour volume assessment in the majority of patients, were known limitations.

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