Original Article

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Choroidal Metastasis in Myriad of Primary Malignancies: A Cross-sectional Study

Radiology Section

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ABSTRACT

Introduction: All metastatic malignancies commonly metastasise to choroid tissue in eye due to its peculiarity in vascular properties; thereof ocular manifestations are most common in the practice of oncology and ophthalmology.

Aim: To investigate the prevalence and clinical pattern of choroidal metastases in myriad of primary malignancies

Materials and Methods: This cross-sectional study was conducted from December 2017 to July 2019 , at Krishna Institute of Medical Sciences, Karad, Maharashtra, on 253 patients with confirmed diagnosis of primary malignancies of breast, lung and ovary with one or more distant metastases with or without ocular symptoms. All patients underwent thorough ophthalmic examination, Ultrasonography (USG) and Magnetic Resonance Imaging (MRI). The continuous and categorical variables were presented in mean±standard deviation and percentages, respectively.

Results: Out of 253 patients, 49 (19.4%) were of breast carcinoma, 52 (20.5%) of lung carcinoma, 127 (50.2%) had gastrointestinal tract malignancy, 8 (3.2%) were of renal cell carcinoma, and 17 (6.7%) had prostate carcinomas. Prevalence of choroidal metastases was 5 (1.9%) of which 1 (20%) in breast and 2 (40%) each in lung, and gastrointestinal carcinomas. Patients with choroidal metastasis were presented with diplopia, pain, and diminished vision. Out of five patients with choroidal metastasis, three patients had choroidal metastasis on right and two had on left-side. Amongst these patients, three had advanced disease, two had retinal detachment, and one had vitreous haemorrhage. USG revealed polygonal heterogeneous echoic mass lesion with irregular surface contour and internal vascularity. MRI revealed T1 isointense, T2 hypointensity well demarcated nodular mass lesion with broad base.

Conclusion: The prevalence of choroidal metastases is very less and tends to occur in the patients with advanced disease.

Keywords: Breast carcinoma, Eye manifestations, Lung carcinoma, Neoplasm, Papilloedema

INTRODUCTION

Breast and lung carcinomas are the most commonly encountered primary malignancies to manifest with choroidal metastases [1]. The incidence of choroidal metastases from metastatic breast cancer was reported to be 0-9.7% in clinical trials, whereas 2-6.7% in metastatic lung cancer. Nevertheless, it was reported as high as 30% in various reports [1]. All metastatic malignancies commonly metastasise to choroid tissue in eye due to its peculiarity in vascular properties. The choroidal metastases are usually associated with an advanced disease and are often asymptomatic and, thus, their diagnosis remains challenging. Bilateral, multifocal metastases are most often secondary to breast cancer, whereas unilateral, unifocal metastasis are more commonly found with lung cancer [2]. Squamous cell carcinoma of head and neck rarely metastasise to eye or orbit, whereas malignancies from breast, lungs, gastrointestinal tract, and prostate commonly metastasise to eye or orbit [3]. Diagnosis could be difficult (in cases without a history of a primary malignancy), particularly with roughly one-half of cases with no detectable primary tumour. Distinct features on ophthalmoscopy and various imaging modalities distinguish choroidal metastases from other choroidal tumours [2].

Many case reports and case series have been published on choroidal metastases associated with malignancies [1,2,4]. However, cross surveys on choroidal metastases in various primary malignancies are still lacking. Hence, the present study was conducted to assess the prevalence and clinical pattern of choroidal metastases in myriad of cancers with primary origin.

MATERIALS AND METHODS

The cross-sectional study was carried out from December 2017 to July 2019, at Department of Radiodiagnosis, Krishna Institute of Medical Sciences, Karad, Maharashtra, India. An Ethical Committee approval was obtained before the initiation of the study. (IEC approval number-KIMSDU/IEC/09/2017) This manuscript adheres to the Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) guidelines [5]. A written informed consent was obtained from all the patients enrolled for the study.

By convenient sampling technique, a total of 253 patients were enrolled in the study based on the inclusion and exclusion criteria.

Inclusion criteria: The patients of either gender with confirmed diagnosis of primary malignancies of breast, lung, gastrointestinal, kidney, prostate and ovary with one or more distant metastases with or without ocular symptoms were included in the study.

Exclusion criteria: Those patients with primary malignancy only without ocular symptoms or distant metastases were excluded from the study.

The data regarding age, sex and the detailed history of patients including primary systemic diagnosis and visual related complaints was collected in predesigned proforma. In addition, the onset, progression, and duration of ocular symptoms were recorded. After thorough clinical examination, all the patients underwent ultrasonographic examination of the orbit using the VOLUSON GE ultrasound system with 12-16 MHz linear probe (GE Healthcare Pvt., Ltd., Mumbai, India). MRI scan of brain and orbit was done using GE 1.5 Tesla system (GE Healthcare Pvt., Ltd., Mumbai, India) in patients with positive USG findings and in patients with primary malignancy with advanced disease (T4 or M1) with clinical suspicion of brain metastases [6].

STATISTICAL ANALYSIS

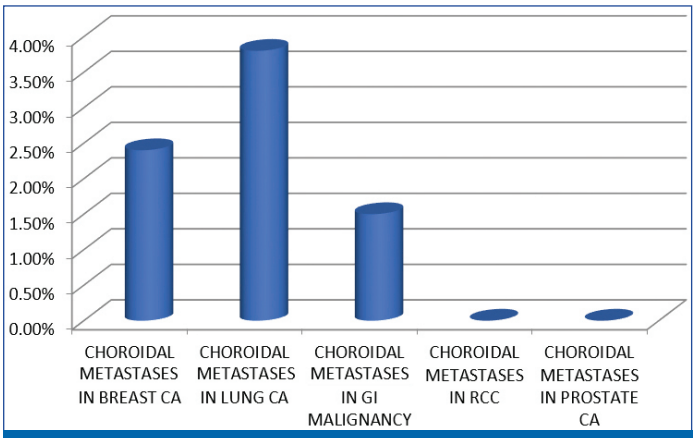
Data were analysed using Microsoft Excel. The continuous and categorical variables were presented as mean±standard deviation and percentages, respectively.

RESULTS

Out of 253 patients, majority of the patients had gastrointestinal tract malignancy (50.2%) and breast carcinoma (19.4%) [Table/Fig-1]. Choroidal metastases were found in one case (2.4%) of breast carcinoma, two patients (3.8%) of lung carcinoma, and two patients (1.5%) of gastrointestinal carcinomas with primary oesophagus and rectum malignancy. None of the patients with renal cell carcinoma and prostatic carcinoma had choroidal metastases [Table/Fig-2].

Malignancy type	Frequency (n=253)	Percentage (%)
Breast carcinoma	49	19.4
Lung carcinoma	52	20.5
Gastrointestinal tract malignancy	127	50.2
Renal cell carcinoma	8	3.2
Prostate carcinomas	17	6.7

[Table/Fig-1]: Frequency of primary malignancies.

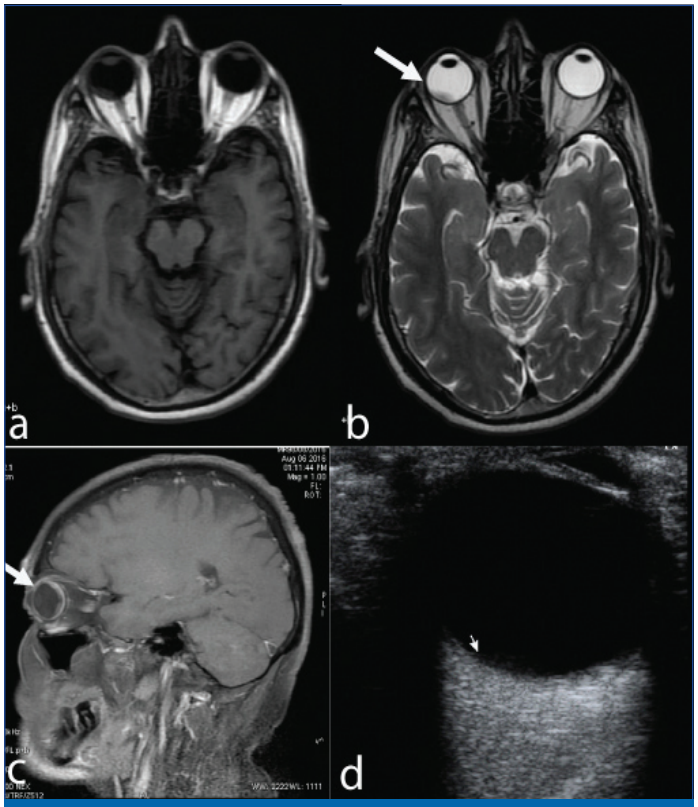


[Table/Fig-2]: Incidence of choroidal metastases in primary malignancies.
CA: Carcinoma; GI: Gastrointestinal; RCC: Renal cell carcinoma

The demographical and clinical characteristics of patients with choroidal metastases are summarised in [Table/Fig-3]. A 60-year-old male patient, known case of carcinoma oesophagus post laparoscopic radical transhiatal oesophagectomy and gastric pull up and end to site pharyngo-gastric anastomosis on neo-adjuvant chemotherapy came with complaints of difficulty in swallowing decreased vision in right eye [Table/Fig-4]. The 53-year-old woman patient, known case of carcinoma left breast, status postmastectomy, chemotherapy and radiotherapy came with the complaints of redness of left eye and decreased vision. [Table/Fig-5] These patients of choroidal metastasis presented with diplopia, pain, and diminished vision. Out of five patients with choroidal metastasis, three patients had choroidal metastasis on right and two had on left-side. A 71-year-male patient, known case of carcinoma lung, came with complaints of shortness of breath, cough and giddiness was incidentally detected with choroidal metastasis. Follow-up of the above patient was done uptil four months post chemo-radiations complaining of decreased vision [Table/Fig-6]. Out of the five patients, three had advanced disease and all the primary neoplasm were adenocarcinoma where two cases showed retinal detachment, two showed only mass lesion and one showed vitreous haemorrhage. A young male aged 28-year-old known case of carcinoma rectum post low anterior resection with pelvic bone metastases and on chemo-radiation complains of pain and diminished vision in the left eye [Table/Fig-7].

Variables	Case 1	Case 2	Case 3	Case 4	Case 5
Age (in years)	71	60	27	28	53
Gender	Male	Male	Male	Male	Female
Primary malignancy	Ca lung	Ca oesophagus	Ca lung	Ca rectum	Ca breast
Clinical presentations	Shortness of breath, cough, and giddiness	Difficulty in swallowing, decreased visual acuity since three months	Shortness of breath, chest pain, headache, and giddiness, blurry vision since two months	Rectal bleeding (painless), decreased visual acuity since two months	Breast lump, Decreased visual acuity since one month
Secondary metastases	Spinal metastases	Absent	Brain metastases, cervico-dorsal spinal metastases	Multiple lesions pelvic bone and soft tissue component	Absent
Unilateral/ bilateral	Right-side	Right-side	Left-side	Right posterior globe and vitreous haemorrhage	Left-side

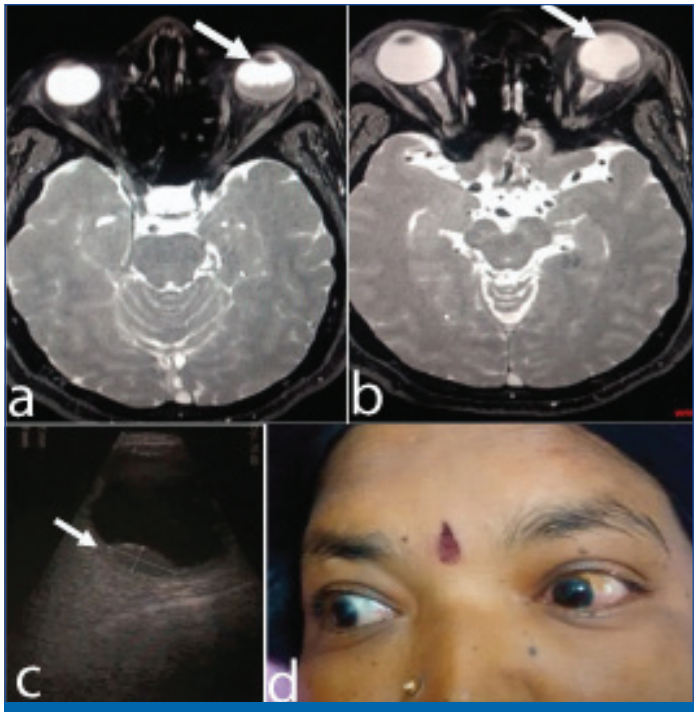
[Table/Fig-3]: Demographical and clinical characteristics of patients with choroidal metastases.



[Table/Fig-4]: A 60-year-old male known case of carcinoma oesophagus post laparoscopic radical transhiatal oesophagectomy and gastric pull up and end to site pharyngo-gastric anastomosis on neo-adjuvant chemotherapy came with complaints of difficulty in swallowing came with complaints of decreased vision in right eye. a & b) T1 and T2 weighted Axial image showed, T1 isointense T2 hypointense mass lesion in the posterior globe of right predominantly in the temporal aspect; c) Sagittal T1 weighted gadolinium enhanced image shows homogenous enhancement of the lesion; d) B-scan of the right orbit shows ill-defined broad based hyperechoic mass along the posterior wall.

Ultrasonographic findings: Choroidal metastases demonstrated lower height to width ratio and showed polygonal heterogeneous echoic mass lesion arising in the posterior globe with irregular surface contour and internal vascularity. In two cases, retinal detachment was seen as thick echogenic cord attached to the posterior wall of the globe giving a V-shaped appearance and moving with the globe [Table/Fig-6,8]. In one case, vitreous haemorrhage is seen as diffuse mobile opacities on high gain, presenting snow globe appearance [Table/Fig-7].

MRI findings: Among patients with choroidal metastases, MRI demonstrates T1 isointense, T2 hypointensity well demarcated nodular mass lesion with broad base, involving the posterior eye globe, which demonstrates near homogenous enhancement on gadolinium contrast administration. There can be associated V-shaped retinal detachment or haemorrhage [Table/Fig-6,8].

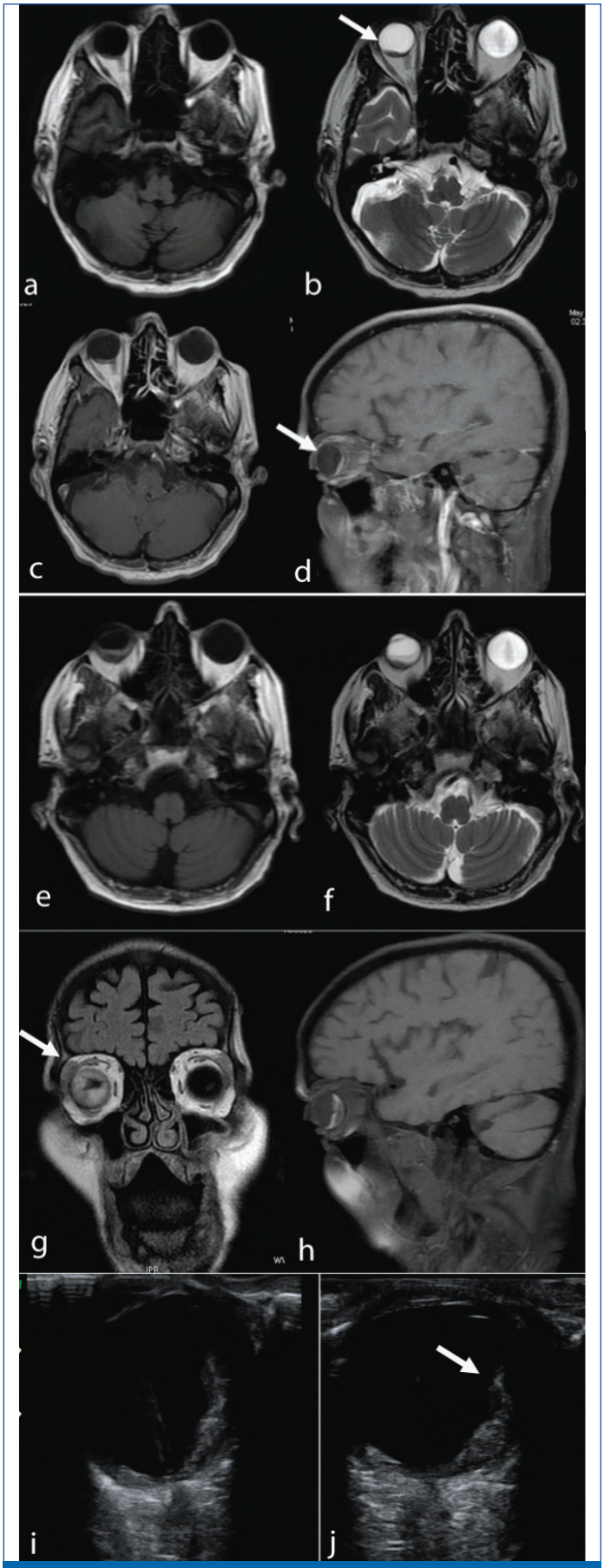


[Table/Fig-5]: A 53-year-old woman known case of carcinoma left breast, status postmastectomy, chemotherapy and radiotherapy came with the complaints of redness of left eye and decreased vision. a &b) T1, T2 weighted Axial images show T1 isointense and T2 hypointense choroidal metastases in the left posterior globe; c) TB scan shows heterogeneous hyperechoic broad based mass lesion; d) Clinical image of patient.

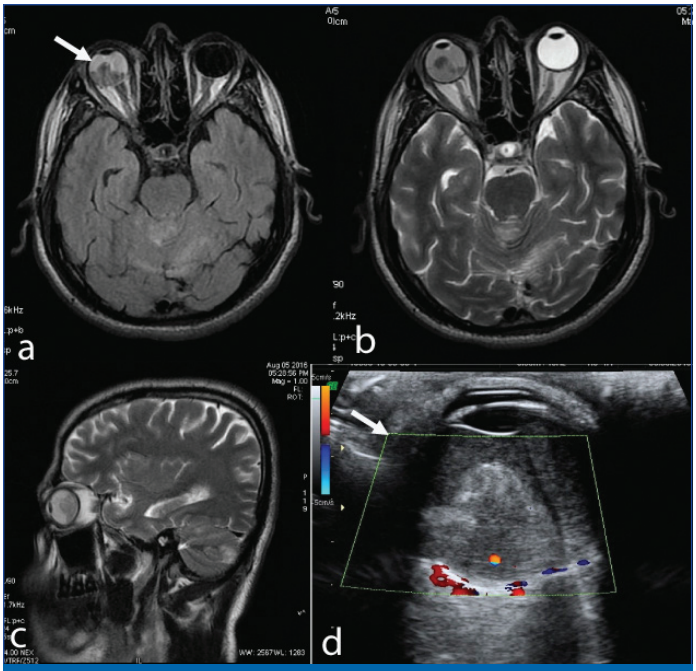
DISCUSSION

Ocular manifestations are most common in the practice of oncology and ophthalmology since all metastatic malignancies commonly metastasise to choroid tissue in eye due to its peculiarity in vascular properties. In this cross-sectional study, 253 patients with various primary malignancies have been studied. The uveal tract being highly vascular is the most common part of the eye involved by metastasis. Choroid (88%) being the most common site followed by iris (9%) and ciliary body (2%) [7]. In the present study, the prevalence of choroidal metastases is 1.97% (five out of 253); two cases of lung carcinoma and one case each of breast, rectal, and oesophageal carcinoma. Kreusel KM et al., conducted a study on 88 patients of primary lung carcinomas and the prevalence of choroidal metastasis was reported to be 7.1% [8]. This contrast finding might be probably due to a higher sample size in this study and, however, the frequency of choroidal metastasis in a myriad of primaries might be underestimated.

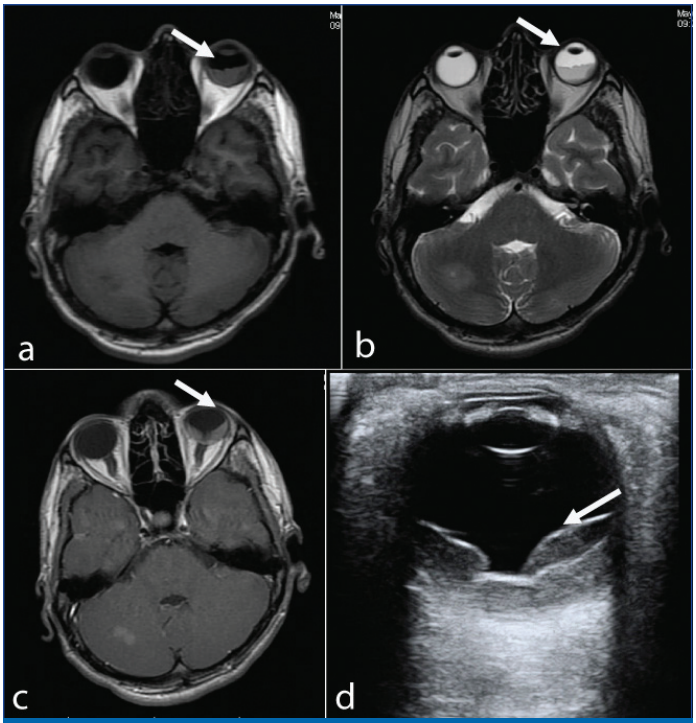
Generally, metastasis to choroid can be unilateral or bilateral. Choroidal metastasis would be unilateral and unique when lung is the primary site of cancer [9]. Same pattern has been observed in the present study. In few studies, 23.8% of patients with uveal metastasis showed bilateral tumours while 72.1% showed unilateral [10]. However, there would be no predilection for metastasis to preferentially affecting the right or left eye [11]. Ophthalmic examination by slit lamp revealed yellow white lesion, flat or ill-defined grey yellow lesion in choroid with possible retinal detachment (two out of 253). Probably, the metastases may lead to exudative retinal detachments accompanied by sub retinal fluid shifting patterns on changing posture. Advanced choroidal metastases may cause exophthalmos, uveitis, monocular diplopia, and glaucoma [12]. In three patients of the present study, choroidal metastasis is with spinal and brain metastasis. Choroidal metastasis is solitary and usually accompanied with other metastatic sites in more than 65% of cases [13]. Choroidal melanoma, choroidal osteoma,



[Table/Fig-6]: A 71-year-male, known case of carcinoma lung, came with complaints of shortness of breath, cough and giddiness. Follow-up of the above patient after 4 month post chemo-radiations complaining of decreased vision. a) T1 weighted Axial image showing isointense mass lesion in the right posterior globe; b) T2 wieghted Axial image showing hypointense mass lesion in the right posterior globe; c&d) The mass lesion shows near homogenous enhancement; e&f) Follow-up T1/T2 weighted Axial imaging after 4 months shows increase in the volume of the earlier detected mass lesion; g&h) Coronal and sagittal T1 weighted gadolinium contrast enhanced images show enhancement of the lesion with v-shaped retinal detachment; i &j) B-scan of the right orbit shows heterogeneous hyperechoic polygonal mass seen along the posterior wall causing retinal detachment.



[Table/Fig-7]: A young male aged 28-year-old known case of carcinoma rectum post low anterior resection with pelvic bone metastases and on chemo-radiation complains of pain and diminished vision in the left eye. a,b,c) T 1 and T2 weighted Axial and Sagittal images show ill-defined irregular heterogeneously hypointense mass lesion in the posterior globe; d) B-scan of the right eye shows large heterogeneously echoic mass lesion in the posterior chamber showing internal vascularity and vitreous haemorrhage.



[Table/Fig-8]: A 27-year-old young male, known case of carcinoma right lung came with brain and skeletal metastases complaints of cough, breathlessness and decreased vision in the left eye. a &b) T1 and T2 weighted Axial images shows T1 isointense, T2 hypointense broad based lesion extending along the nasal and temporal aspect of the left posterior globe; c) T1 weighted post gadolinium contrast image shows enhancement of the mass with retinal detachment. Ill-defined enhancing metastatic lesion also seen in the right cerebellar hemisphere; d) B-scan of the left eye shows large heterogeneous hyperechoic mass causing v-shaped retinal detachment.

neovascularisation (with disciform scar) and other rare lesions can also mimic choroidal metastasis making its diagnosis in patients with idiopathic primary quite challenging [13]. None of the patients presented with choroidal melanoma, choroidal osteoma, and disciform scar in this study.

Imaging modalities plays an important role in incidental detection of lesions in asymptomatic patients. On USG, diffuse echogenic sub-retinal mass with ill-defined border was observed with internal vascularity not shifting with ocular movements. In the present study, among patients with retinal detachment, a moderate sound attenuation was observed in the lesions. Shields CL et al., reported that the thickness of metastasis depends on the primary neoplasm; mean thickness of metastasis secondary to gastrointestinal and kidney is 4 mm, lung and prostate is 3 mm, breast is 2 mm,and melanoma is 1 mm [14]. Choroidal metastasis shows fluorescence in early phases with progressively hyper fluorescent in venous (late) phases, later than most choroidal melanoma [4,15]. In case of carcinoma left breast, axial images revealed T1 isointense and T2 hypointense choroidal metastases in the left posterior globe. Similarly, many case reports also revealed that metastasis appear isointense on T1 weighted images and hypointense on T2 weighted images [4,16].

It is essential to look in the orbit for the early detection of asymptomatic with choroidal metastases and can lead to early initiation of treatment resulting in increased survival rates in patients with advanced metastatic diseases.

Limitation(s)

Our study had few limitations. First, in the present study, the authors did not correlate findings of USG with MRI and clinical findings with diagnosis. Secondly, the authors could not correlate the findings of this study with individual chemotherapies by patients as they could not provide enough drug information.

CONCLUSION(S)

The prevalence of choroidal metastases is very less and tends to occur in the patients with advanced disease (Tumour (T)4/Metastasis (M)1). Future studies are required to study the risk analysis of ocular symptoms with different treatment modalities available for malignancies, as increased survival rate by these treatments are probably at higher risk to metastasise.

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