

Epworth Sleepiness Scale- a novel tool to assess somnolence syndrome in patients receiving radiotherapy to the brain

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Abstract

Purpose: Radiation to brain causes early, early-delayed, and delayed side effects. There is paucity of literature regarding early-delayed effects like somnolence syndrome. Existing studies use general symptom assessment and visual analog scales. Epworth Sleepiness Scale (ESS) is a time tested tool to assess daytime sleepiness in various conditions. In this study, the ESS has been used to determine the occurrence of somnolence in patients receiving cranial radiotherapy for primary and metastatic brain tumors. Thus the ESS has been used in a novel setting in our study. The ESS is a simple to administer questionnaire and may be useful in grading the severity of somnolence. To our knowledge, this is the second study to determine post radiation somnolence using ESS. **Methods:** This prospective study was conducted in 23 patients with primary and metastatic brain tumor. Patient demographics and tumor type and grade was noted. Those with Karnofsky Performance Scale (KPS) less than 70 and with pre-existing sleep disorders were excluded. Radiotherapy regimen included palliative whole brain radiation for brain metastases and conformal adjuvant radiotherapy for primary brain tumors as per standard guidelines. All subjects included were administered ESS at baseline and weekly thereafter during and for 6 weeks after radiation. **Results:** All 23 patients (median age 50 years) completed the planned questionnaires until 6 weeks post radiation. Twenty (87%) patients had primary brain tumors whereas three (13%) patients had metastatic lesions in brain. Of the 23 patients, 14 patients (60.86%) had abnormal or increased daytime sleepiness; of which 3 had ESS scores greater than 16. **Conclusion:** Somnolence was noted in 60.86% of the patients, which is in accordance with existing literature. Epworth sleepiness scale is an effective tool to detect and quantify somnolence. However, it does not consider other symptoms of somnolence syndrome and hence should be combined with visual analog scale to get complete information.

Keywords: Brain Malignancy; Epworth Sleepiness Scale; Radiation Therapy; Sleepiness; Somnolence Syndrome

Introduction

Malignant tumors of the brain are either primary or metastatic, the latter being more common. Metastases commonly arise from lung, breast, colo-rectum, etc.¹ The primary tumors are most often neuro-epithelial in origin; namely astrocytomas, oligodendrogliomas, ependymomas, amongst others. As for any malignancy, the three broad treatment options are surgery, radiation therapy and chemotherapy. Radiation therapy forms the mainstay of treatment, either alone or in an adjuvant setting. In view of the blood brain barrier, chemotherapy has limited role, commonly as a radio-sensitizer in high grade gliomas. Radiotherapy plays the prime role in management of brain metastases. The most time tested modality is whole brain radiotherapy, commonly to a dose of 20- 30 Gy in 5 to 10 fractions. Radiotherapy also plays a key role in primary brain tumors. The treatment in-

volves maximal safe resection followed by adjuvant radiation to a dose of 54 to 60 Gy with or without chemotherapy depending upon histology and grade of the tumor.

Radiotherapy causes a number of adverse effects- and have been divided into acute, sub-acute and delayed. Acute effects occur during radiation and up to 6 weeks of completing radiation. They can present with transient worsening of pre-treatment deficits during radiotherapy or can manifest as general symptoms like fatigue, headache, and drowsiness. Late effects include neuro-cognitive dysfunction and brain necrosis.

Sub-acute or early delayed effects include head ache, fatigability and somnolence syndrome. Although early and de-

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layed effects are well documented, Somnolence syndrome is less studied. Commonly, general symptom assessment and ranking on visual analog scale are undertaken to study this syndrome.^{2,3}

Epworth Sleepiness Scale (ESS) is an instrument to measure day time sleepiness and is a useful tool to diagnose sleep disturbances.⁴ On the basis of scores obtained, propensity to sleep can be categorized and this can potentially help to quantify somnolence. This study is undertaken to study the incidence of somnolence in the patients in our department receiving radiotherapy to brain using Epworth Sleepiness Scale.

Methods and Materials

Patient population

This is a prospective study based on the patients with histologically proven primary brain tumors or brain metastases treated in our department with radiation therapy from January 2013 to December 2013. Patient demographics and tumor type- primary or metastatic along with grade was noted. Patients with Karnofsky performance status less than 70 and those with pre-existing sleep disorders were excluded from the study.

Treatment

Patients with primary brain tumors were subjected to initial surgery ranging from stereotactic biopsy to total decompression followed by radiation therapy to a dose of 5400 to 5940 cGy in conventional fractionation depending upon the histology and grade of the lesion. The post-op tumor bed along with residual disease with adequate margins were the volumes of interest. Metastatic brain tumors were treated with whole brain radiotherapy to a dose of 3000cGy in 10 fractions as per departmental protocol.

THE EPWORTH SLEEPINESS SCALE	
Name: _____	
Today's date: _____	Your age (years): _____
Your sex (male = M; female = F): _____	
How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you. Use the following scale to choose the <i>most appropriate number</i> for each situation:	
	0 = would <i>never</i> doze
	1 = <i>slight</i> chance of dozing
	2 = <i>moderate</i> change of dozing
	3 = <i>high</i> chance of dozing
Situation	Chance of dozing
Sitting and reading	_____
Watching TV	_____
Sitting, inactive in a public place (e.g. a theater or a meeting)	_____
As a passenger in a car for an hour without a break	_____
Lying down to rest in the afternoon when circumstances permit	_____
Sitting and talking to someone	_____
Sitting quietly after a lunch without alcohol	_____
In a car, while stopped for a few minutes in the traffic	_____
Thank you for your cooperation	

FIG. 1: Epworth Sleepiness Scale.⁴

Assessment for somnolence

Patients were subjected to Epworth Sleepiness Scale⁴ (Figure 1) at baseline, thereafter every week during radiation; also continuing weekly after cessation of radiation until 6 weeks post treatment.

Results

Demography, Tumor characteristics and Performance status

Twenty three patients were assessed and all completed the questionnaire weekly during treatment and for 6 weeks post treatment. Patients' age ranged from 25 to 65 years with a mean of 47.7 years and median of 50 years. 13 patients were males and 10 were females.

Twenty patients had primary brain tumors and 3 patients had metastatic disease (Figure 2). Two patients had metastases from primaries in the breast while one had from testes. Of the 20 patients with primary brain malignancies, 1 patient had primary central nervous system melanoma, one had papillary tumor of pineal region and 18 had gliomas, of which one was low grade and 17 were high grade gliomas.

The Karnofsky Performance Scale (KPS) ranged from 70 to 90. Twelve patients had a KPS of 90 while 5 had a KPS of 80 and 6 had a KPS of 70.

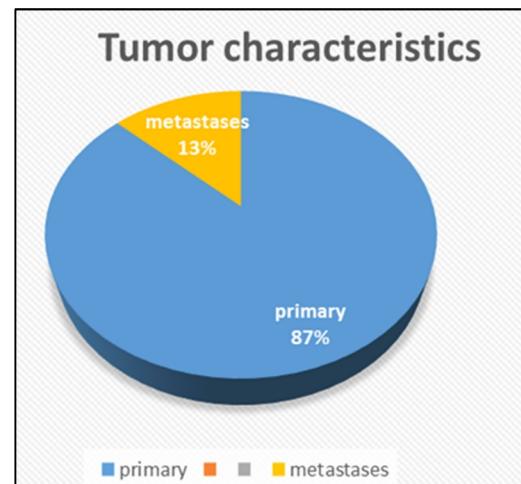


FIG. 2: Pie chart showing tumor characteristics of the patients.

Assessment of somnolence

Of the 23 patients (Figure 3), 14 patients (60.86%) had increased daytime sleepiness. Three out of these 14 (21.4%) patients were severely sleepy (ESS score: 16-24).

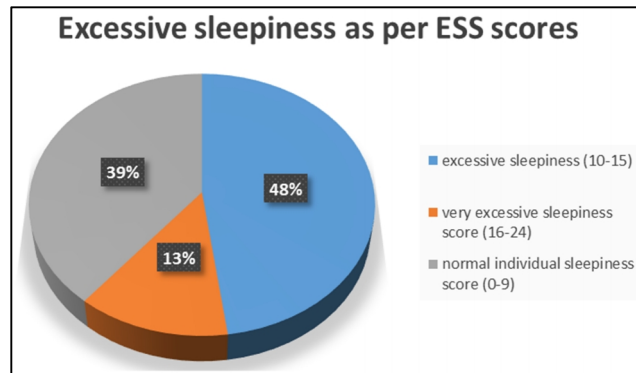


FIG. 3: Pie chart showing patients sleepiness ESS scores.

One out of the 3 patients (33%) with brain metastases developed somnolence. In the remaining 13 sleepy patients who had primary brain tumors, increase in ESS scores occurred at 5-6 weeks post radiotherapy in 9 patients and earlier in the remaining 4 patients (3 patients in 2nd week and 1 patient in 4th week).

Discussion

Somnolence syndrome is an early-delayed side effect of radiation treatment to the brain. The condition was first documented by Druckmann in 1929, when treating children for ringworm of the scalp with 150kV X-ray.⁵ It has generally become recognised as a condition affecting children with acute lymphocytic leukemia (ALL) after receiving prophylactic cranial irradiation.^{6,7} However, studies have begun to report that somnolence also appears in adults after irradiation for primary brain tumours.^{2,3}

In the present study, we have found an incidence of excessive sleepiness (one of the symptoms of somnolence syndrome) in 60.86 % of the individuals, which is in concordance the 62.9% incidence reported by Parker *et al.*⁸ in children receiving cranial irradiation. In the latter study, EEG changes like pathological symmetric slowing of the dominant rhythm and excessive diffuse theta components were used as a method to detect presence of somnolence.

Faithfull S and Brada M reported incidence of somnolence syndrome in 16 of 19 patients (84.2%).² This is considerably higher than our reported findings. They have used a prospective diary using visual analog scales of common somnolence symptoms and fatigue. They found that although patients experienced increased drowsiness, lethargy, clumsiness and slow mental processes, they did not require more sleep. Patients commented on the symptoms being 'a sensation that was mentally disabling and a disruption to physical activity by an overwhelming feeling of exhaustion'. Assessment of other symptoms along with propensity to sleep could have resulted in the higher somnolence rates in their study.

The timing of somnolence correlates well with other reported literature; i.e., the symptoms most commonly begin at 5-6 weeks post radiation therapy.⁹ However Faithfull and Brada reported a distinct pattern.² They found that all patients in their study developed symptoms two weeks post-treatment completion. Symptoms then resolved only to resurface in the fifth week, lasting two to five days. Like all other studies, such a bimodal presence of somnolence was not found in our study.

Epworth Sleepiness Scale is a validated eight-item questionnaire wherein the subject is asked to rate on a four point scale (0-3) his/her likelihood of falling asleep in 8 different situations. Scores range from 0 (the least sleepy) to 24 (the most sleepy). The higher the score, the higher the level of persons' daytime sleepiness. Scores equal to or above 10 are interpreted as increased daytime sleepiness.

The Epworth Sleepiness Scale has been validated in sleep disorders using Multiple Sleep Latency Test.³ Multiple sleep latency tests measure the propensity to fall asleep when the patient is given 4-5 programmed 20 to 40 minute nap opportunities 2 hours apart during daytime with EEG, EOG and EMG monitoring. In our study, sleep latency monitoring has not been done.

The use of Epworth Sleepiness Scale in assessing somnolence syndrome in patients receiving radiation therapy to brain is a novel approach and has been used in only one previously reported study in the surveyed literature till date. Azita Gilaridi from University of California- Los Angeles has used Epworth Sleepiness Scale along with other scales and an actigraphic watch to measure somnolence.¹⁰ It is an easily available and a simple questionnaire. Besides, it can effectively grade the severity of somnolence based on the scores being 11-15 and 16-24.

The major limitation of using the ESS alone in assessing radiation induced somnolence, is that it can detect only increased sleepiness from the spectrum of symptoms encompassing this entity, which can range from mild drowsiness to extreme exhaustion, low-grade fever, nausea, anorexia and headache. Besides, the self-scoring and gradation of scoring in the ESS introduce an element of subjectivity. Hence, using the Epworth Sleepiness Scale along with assessment of common symptoms of somnolence syndrome and addition of an objective tool like Littman scale⁶ will be more accurate in making a definitive diagnosis of somnolence syndrome.

Merits of the study

It is a prospective study. To the best of our knowledge, it is the first study using Epworth Sleepiness Scale as the sole tool to assess post radiation somnolence syndrome

Limitations

The sample size is small and only 3 patients had metastatic brain cancer. Hence, a meaningful comparison of somnolence at various doses could not be undertaken.

Future prospective

Epworth Sleepiness Scale can be used along with visual analog scale for assessment. Together, the symptomatology will be better understood along with quantification of somnolence.

Conclusion

Somnolence occurred in 60.86% of the patients who underwent radiation treatment for brain tumors, which is in accordance with existing literature. Epworth Sleepiness Scale is an effective tool to assess somnolence. However, it assesses for only one of the components of somnolence syndrome. It will be ideal to combine it with scales for assessment of other relevant symptoms.

Conflict of interest

The authors declare that they have no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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