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EVALUATION OF SIGNAL INTENSITY OF INTRA AXIAL AND EXTRA AXIAL BRAIN TUMORS THROUGH THE DIAGNOSIS OF MAGNETIC RESONANCE IMAGING

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ABSTRACT

The estimation of the lifetime risk of humans with brain tumor lesions or other nervous system cancer is around 0.6 percent. Brain tumors include intracranial metastases, meningioma, gliomas, etc.The brain lesions can be classified into intra-axial and extra-axial, depending on the location. Magnetic Resonance Imaging (MRI) helps in the differentiation of extra-axial and intra-axial brain tumorsThe purpose of this study is to assess the increasing incidence of brain lesions and to compare the changes in the MR signal intensity patterns for the differential diagnosis of intra-axial and extra-axial brain lesions in patients for early detection and management. This study was conducted in the Radiology Department of one of the major tertiary health care centers in South Kerala. Patients suspected of brain tumors were subjected to MRI. The brain tumors were categorized into intra-axial and extra-axial tumors. In this study, 69 patients were included and studied for their socio-demographic characteristics, and the signal intensity of T1wt images and T2 wt MRI images were evaluated. Statistical analysis was done by SPSS version 16. In this study, MRS images of 69 brain tumor lesions were studied and compared for the socio-demographic characteristics and the signal intensity of MRI imaging for both intra-axial brain tumors and extra-axial brain tumors. It was found that meningioma is the most common type of brain lesion. Results also detected that most of the intra-axial brain tumors, appeared as hyperintense in T2 wt images compared with T1 wt images.But the extra-axial tumor-like tuberculoma appeared as hyperintense in T1 wt images and T2 wt images. Magnetic Resonance Imaging has a wide range of sensitivity to evaluate the differential diagnosis of brain lesions in both extra-axial and intra-axial tumors.

Keywords: extra-axial brain tumors, intra - axial brain tumors, magnetic resonance imaging

INTRODUCTION

Human with brain tumor lesions or other nervous system cancers, the lifetime risk is estimated to be around 0.6 percent described by Allen Perkins et al .,2016. Tumors including malignant and non malignant brain tumor and other central nervous system tumors comprises with varying descriptive epidemiology, clinical characteristics, treatments, and outcomes reported by Kimberly et al.,2021. Brain tumors can be classified into intra-axial or extra-axial tumors depending on their location..The intra-axial tumors are found inside brain parenchyma and emerge from the brain cells, whereas the extra-axial tumors are found exterior brain parenchyma and emerge from structures lining the brain or encompassing it explained by Chougule 2020 . Extra-axial brain tumors are the most common intracranial neoplasms and incorporate a wide extend of pathologic subtypes. Meningiomas are detailed as the foremost common extra-axial brain tumor .This sorts of tumors are displayed as gradually developing dural-based masses enumerated by Rapalino et al., 2016. Intra-axial brain tumors lead to the dreariness and mortality and join a wide combination of pathologic subtypes with variable biologic forcefulness. These tumors expand from pseudotumoral injuries such as the dysplastic gangliocytoma of cerebellum to exceedingly threatening and forceful tumors such as glioblastoma illustrated by Rapalino et al.,2016 . It was found **that** neuroimaging technology has developed rapidly from the discovery of X-ray, CT (Computerized Tomography) and up to the latest MRI by Norhashimah et al.,2015 . These imaging modalities can be used for diagnostic purposes like localization, assurance of aetiology, and follow-up of the infection. From these modalities, MRI presents the leading delicate tissue differentiate discovery and demonstrative sensitivity described by Alveset al.,2020. The MRI images gives diverse image differentiate depends on their tissue substance. The differentiate within the MRI images are due to the shifting flag escalated found by Acharya et al.,2016. Besides for the evaluation of brain injuries gadolinium improvement plays an critical part. With the assistance of gadolinium upgrade, the variation from the norm on T2 or T2 Energy images can be affirmed reported by Filippi et al.,2019 .

Inspite of differentiate instrument, images can be weighted like T1 weighted (T1wt), T2 weighted (T2wt) and Proton Thickness weighted (PD wt). They are distinctive in their flag escalated confirmed by Trip et al.,2005 . The flag concentrated of both additional pivotal and intra pivotal brain tumors can be analyzed noninvasively both in T1 wt pictures and T2 wt images. The purpose of this study is to assess the increasing incidence of brain lesions and to compare the changes in the MR signal intensity patterns for the differential diagnosis of intra-axial and extra-axial brain lesions in patients for early detection and management.

MATERIALS AND METHODS

This study was conducted within the Radiology Department of one of the major tertiary health care centres in South Kerala. Patients suspected of brain tumor injuries and who experienced MRI for conclusion was included in this think about. The study was approved by the Institutional Ethics Committee. In this study both males and females were included. Patients with the proven MRI determination were as it were included as study subjects. In this study MR imaging of 69 patients with diverse brain tumor injuries were taken. The brain tumor patients are then categorized into extra axial tumors and intra axial tumors.They include the extra axial tumors(n=24)like adenoma(n=6), cerebellopontine angle tumor(n=9) and meningioma(n=19).Similarly the intra axial tumors(n=45)like glioma(n=4),glioblastoma(n=6),lymphoma(n=4),metastatis(n=8),oligodendroglioma(n=4), subependymoma (n=4) and tuberculoma(n=3)

A 1.5-T scanner was used for imaging. The images were produced utilising a head coil with a diameter of 30 cm, spin-echo pulse sequences, gradient echo sequences, FLAIR, and a two-dimensional Fourier transform image reconstruction. Nuclear magnetic relaxation was discovered as the underlying cause of signal contrast between various tissue types denoted by Crameret al.,2014.Depending on the particular time constant, there were two different relaxation processes described by Katie et al.,2011.These are the transverse decay and longitudinal magnetization recovery processes.The T1 relaxation, also known as a longitudinal radio frequency pulse, is the amount of time needed to regain roughly 63% of their pre excitation magnetization. T1 wt images were created using slice selection and RF pulses, and the tissues with shorter T1 relaxation times produced greater signal intensities Ginatet al.,2012.Between slice selection and the RF pulses, the TR (Time of Relaxation) determines the T1wt images. Given that T1 is an exponential growth time constant, a tissue with a short T1 could provide a hyperintense signal while a tissue with a long T1 might appear dark in an MR image. Transverse relaxation , often known as T2, is the indicator of transverse magnetization decay. T2 is the amount of time needed for the transverse magnetization to decrease to 37% of its initial value described by Poley.,2005. T2 wt pictures are determined by TE (time of Echo) in milliseconds Jacobs et al.,2007 . The signal contrast mechanisms, such as T1 and T2 relaxation, were employed to visualise the contrast agents for normal anatomy and disease.Tissues with longer T2 relaxation times were hyperintense on T2 wt images, whereas those with shorter T2 relaxation times seemed hypointense reported by Zimny et al.,2015.T1 wt images are excellent for identifying anatomical structures, but when contrast is added, diseased entities can also be seen. In contrast, T2 wt images depict disease because pathological processes have greater water content and appear brighter on T2 wt images Bitar et al.,2006 .T1-wt spin-echo images were obtained from all of the patients, as well as T2-wt spin-echo, FLAIR, gradient echo images (2500–3000/30, 80/1), and post contrast T1-weighted images following intravenous gadolinium injection (0.1 mmol/kg body weight). A 256 × 256 matrix was used to capture every image, with a field of view of 23 cm. In T1 and T2wt images, the signal strength and degree of enhancement from MR scans were compared to brain tumour lesions. Both T1 and T2 weighted images of brain tumour lesions were used to compare the alterations in anatomical features as a measurement of signal strength. Software called SPSS version 16 was used for the statistical analysis. Chisquare test was used for comparison. Statistical significance was determined by a p-value of 0.0001.

RESULTS AND DISCUSSION

This was a hospital based study and through the study, it was detected and analyzed the types of brain lesions having different signal intensity in T1 wt and T2 wt MRI images in patients including extra axial brain tumors and intra axial brain tumors. In this study 69 brain tumor lesion cases including extra axial(n=24) and intra axial tumors(n= 45) were studied.The extra axial tumors(n=24)like adenoma(n=6), cerebellopontine angle tumor(n=9) and meningioma(n=19) and similarly the intra axial tumors(n=45)likeglioma(n=4),glioblastoma(n=6),lymphoma(n=4),metastatis(n=8),oligodendroglioma(n=4), subependymoma (n=4) and tuberculoma(n=3) were included in this study . The T1 wt and T2 wt images were compared for their intensity and percentage for both extra axial and intra axial tumors. Table 1 compares T1 weighted images to T2 weighted images for both extra axial and intra axial tumors.It was found that in T1wt images, extra axial tumors(n=24)like adenoma(n=6), cerebellopontine angle tumor(n=9) and meningioma(n=19) were appeared as hypointense in T1 wt images. But in the case of intra axial tumors(n=45)likeglioma(n=4),glioblastoma(n=6),lymphoma(n=4),metastatis(n=8),oligodendroglioma(n=4), subependymoma (n=4) the T1 wt images are appeared as hypointense.Where as the the intra axial tumor tuberculoma(n=3) were detected as hyper intense in T1wt images . On T1wt images, however, the tuberculoma was seen to be extremely intense. In T2wt images the extra axial brain tumor lesions (n=24)like adenoma(n=6), cerebellopontine angle tumor(n=9) and meningioma(n=19) were as hyperintense.The intra axialtumors(n=45)likeglioma(n=4),glioblastoma(n=6),lymphoma(n=4),metastatis(n=8),oligodendroglioma(n=4), subependymoma (n=4) and tuberculoma(n=3) were also appeared as hyperintense in T2 wt images MRI Table 1. Comparison between T1wt hypointense , hyperintense images and T2 wt hypointense and hyperintense images in Extra axial brain tumors and Intra axial tumors

Table 1: T1 and T2wt images

T1 wt images		**T2 wt Images**	
Extra Axial brain tumors		**Intra axial brain tumors**	
Hypointense	**Hyperintense**	**Hypointense**	**Hyperintense**
Adenoma	--	--	Glioma
Cerebellopontine angle tumor	--	---	Glioblastoma
Meningioma	---	---	Lymphoma
	---	--	Metastatis
	---	---	Oligodendroglioma
	---	---	Subependymoma
	---	--	Tuberculoma

It was discovered that Mc Nemar's chi square value was 21.44 with a p-value of 0.0001. There is a relationship between T1wt images and T2wt images in both extra axial and intra axial malignancies since the p-value was significant. These details helped to foretell the kind of signal

intensity that would be useful in the differential diagnosis for an early cure and prompt intervention.

The extra axial tumors, such as adenoma, were discovered to present as hypointense in T1 wt images and hyperintense in T2 wt images in this study. The lesion, an adenoma, was seen as hyper or isointense in T2wt images and hypointense or isointense in T1 wt images, according to a recent study by Rousset et al.,2009 . Meningiomas, an extraaxial tumour, were discovered to manifest as hypointense in T1wt images and hyperintense in T2wt images in the current investigation. The firm meningiomas were reported to be hypointense on T2 and isointense on T1 wt images, contrary to the soft meningiomas which were observed as hyperintense on T2 and hypointense on T1 wt images described by Jason et al 2011. Meningiomas were found to be hyper- or isointense in T2 wt images and hypo- or isointense in T1 wt images described by Rousset et al.,2009 .

The intra axial tumours included in the current investigation have signal intensities that are hypointense on T1wt imaging and hyperintense on T2wt images. Malignant glioma were noted as hyperintense regions in T2 wt images , according to earlier investigations by Kono et al.,2001 . This study's intraaxial tumour, which resembled a glioblastoma, showed up as hyperintense on T2wt images but hypointense on T1wt images. Recent studies also demonstrate that on T2-FLAIR sequences by Shukla et al.,2017 reported that the glioblastoma lesion appeared as hyperintense. When lymphoma was the subject of this investigation, the MRI results revealed that the signal intensity presented as hypointense in T1wt images and hyperintense in T2wt images.The CNS lymphoma was also shown to be iso or hyperintense in T2 wt imaging and hypointense or isointense lesions in T1 wt images, according to earlier findings described by Haldorsen et al.,2011.

In T2wt images from this study, the glioma was seen as hyperintense. Malignant gliomas were seen as hyperintense regions in T2 wt imaging in early studies as well explained by Konoet al.,2001.Meningiomas were observed as hypointense in T1wt images and hyperintense in T2wt images in the current investigation.Microcystic meningiomas are shown to be hypointense in T1wt images and hyperintense in T2wt images, according to one of the investigations. Angiomatous meningioma and secretory meningioma were also verified to be seen as hypointense on T1 wt images and hyperintense on T2 wt imagesillustrated by Kunimatsu et al.,2016. Early research also showed that whereas hard meningiomas were discovered as hypointense on T2 and isointense on T1 wt imaging, soft meningiomas were found to be hyperintense on T2 images. Meningiomas were reported to be hyper- or isointense in T2 wt images and hypo- or isointense in T1 wt images described by Rousset et al.,2009.The intra-axial brain tumour lesion similar to metastatis was discovered to be hypointense in T1 wt images and hyperintense in T2 wt images in the current investigation. It was also shown that the metastatic lesion in one of the earlier investigations presented as hypointense on T1wt imaging and as hyperintense on T2 wt imaging reported by Zimny et al.,2015 . Also, other investigations found that intraparenchymal metastasis was a common occurrence and that it manifested as nodular enhancement in MRI images as well as hypointense on T1 wt images and hyperintense on T2 / FLAIR images reported by Granda et al., 2014. In the current investigation, it was discovered that intra-axial tumours like oligodendrogliomas showed up as hypointense on T1 wt MRI images and hyperintense on T2 wt images. Similar to this, it was discovered in one of the investigations that the signal intensity in oligodendroglioma was

detected as hypointense in T1 wt images and hyperintense in MRI images by Ruiping et al., 2017 . The MRI results from this study showed that intra-axial tumours such tuberculomas had hyperintense signals on both T1-weighted and T2-weighted images. In one of the earlier research, it was discovered that the T2 as core was iso to hypointense with hyperintense rim for tuberculoma explained by Sharmaet al.,2013 .

In the current investigation using MRI imaging of subependymomas, it was discovered that the lesions were shown as hypointense in T1 wt images and hyperintense in T2 wt images. Also, it was discovered in one study that subependymomas were seen as isointense or hypointense on T1 wt images and hyperintense on T2 wt MRI imaging, which results in an 80% enhancement after the administration of gadolinium contrast agents Amit et al.,2012 .

CONCLUSION

An excellent method for identifying extra- and intra-axial brain tumours is MRI. Given the prevalence of brain lesions nowadays, knowledge of signal intensities is crucial for the accurate diagnosis of brain lesions. One of the best ways to evaluate soft tissue involvement and their augmentation is through imaging modalities like MRI. The imaging of MRI signal intensities offers data for both diagnostic and therapy planning. We might infer from this study that most brain tumour lesions, such as extra- and intra-axial tumours, appeared as hyperintense in T2 wt images compared to T1 wt images. However, both T1 wt and T2 wt scans showed an intraaxial tumour that resembled a tuberculoma as being hyperintense. As a result of the distinctive clinical and imaging characteristics of the various types of brain tumour lesions, a superior differential diagnosis based on signal intensity variation is possible.

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