

Concise Algorithmic Approach to White Matter Lesions on Adult Brain MRI

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Abstract

White matter hyperintensities (WMH) on brain MRI were met in some clinical settings. There are many differential diagnoses for white matter lesions on MRI. The most common causes include demyelinating, infectious, inflammatory, metabolic, deficiency, vascular and neoplastic disorders, which create confusing challenge in diagnosis. The list of conditions causing WMH on MRI is exhaustive, and thus we need to discuss in compendious manner.

The purpose of this review is to make an algorithmic approach to consider essential disorders presenting as white matter hyperintensities on MRI.

Distinguishing parameters such as pattern of lesion, location and enhancement features should take into account to assist in diagnosis. The distribution and appearance of the MRI lesions most often suggest the correct diagnosis. We therefore categorized these disorders based on following items: I. Patchy or diffuse lesions II. Predominant region of brain involvement III. Symmetric or asymmetric distribution IV. Enhancing or non-enhancing.

These algorithms could lead us to more accurate and rapid access to diagnosis of main diseases at clinic.

Keywords: Brain; White matter; MRI; Hyperintensity

Introduction

Leukoencephalopathies comprise all disorders that affect exclusively the white matter of the brain [1]. Magnetic resonance imaging (MRI) in leukoencephalopathies manifest as white matter hyperintensities (WMH) on T2-weighted MRI scans or fluid attenuated inversion recovery (FLAIR) [2,3]. WMH could be adult onset or present in infancy or childhood. If it is inherited it is called leukodystrophy which is the progressive destruction or loss of previously acquired myelin mainly with a metabolic origin. WMH can be a consequence of vascular, inflammatory, demyelinating or neoplastic disorder [4-6]. The list of different pathologies causing WMH on imaging is exhaustive. The related clinical findings are sometimes non-specific and might overlap as well [4]. The diagnostic workup can be complicated, expensive and sometimes inconclusive.

MRI has allowed new understandings and classifications of leukodystrophies that have significantly enhanced our diagnostic ability in clinical setting. The distinctive features of WMH on MRI can help narrow differential diagnosis [7,8]. The location of lesions in different regions of brain, whether they are symmetric or asymmetric, enhancing or non-enhancing, confluent, isolated or multifocal can all be of high diagnostic value.

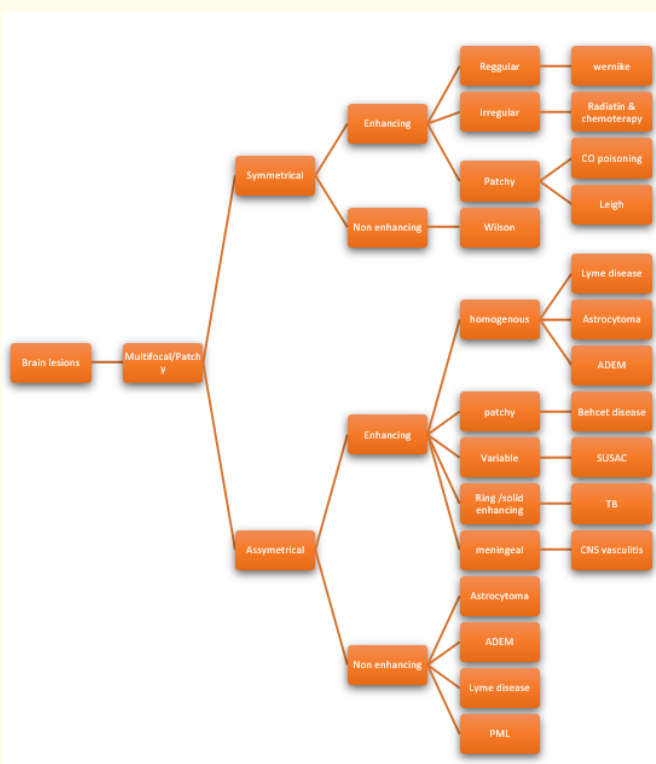
MRI pattern recognition can facilitate differentiating underlying pathologies in diagnostic assessments [3,4]. The purpose of this study is provide an algorithmic approach to WMH findings on MRI with a focus on lesions' locations, patterns and enhancement features to assist in clinical diagnostic setting.

Proposed algorithms

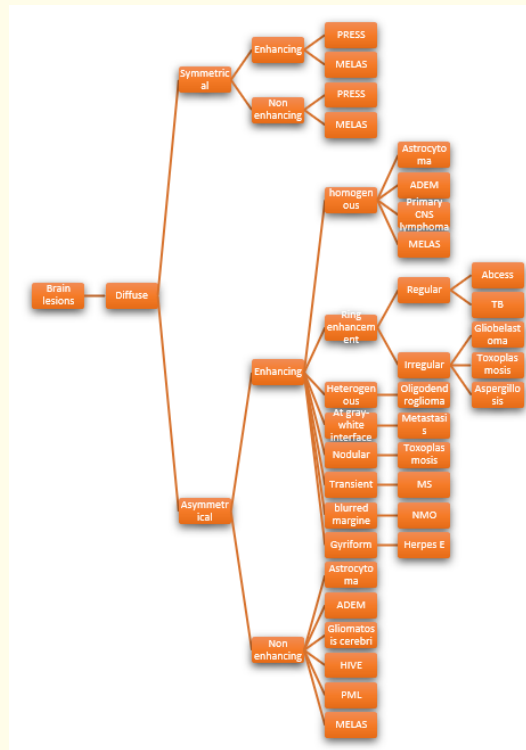
For the proposed algorithmic approach, we first categorized WMH as diffuse or multifocal, which were further subcategorized into symmetric or asymmetric pattern and enhancing or non-enhancing ones (Algorithm 1 and 2). The second and third algorithms will further subcategorize multifocal or diffuse lesional pattern into symmetric or asymmetric pattern and enhancing or non-enhancing ones respectively. Another approach would be based on brain region involvement as demonstrated in algorithm 3 and 4.



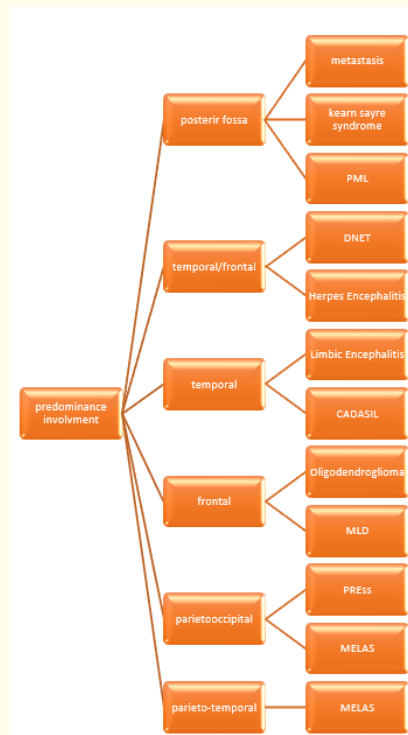
Algorithm 1: Multifocal or diffuse lesions are categorized into symmetric or asymmetric and further subcategorized into enhancing or non-enhancing lesions.



Algorithm 2: Sub categorization of multifocal lesions into symmetrical, asymmetrical and further into enhancing and non-enhancing.



Algorithm 3: Subcategorization of diffuse lesions into symmetrical, asymmetrical and further into enhancing and non-enhancing.



Algorithm 4: White matter lesional categorization based on brain region involvements.

Discussion

In this article, we summarized and suggest algorithmic approach for adult onset white matter hyperintensities on brain MRI to facilitate clinical diagnosis based on MRI findings in details. These algorithms consider predominant localization of lesions, the pattern of distribution, whether these lesions are symmetrical or asymmetrical, enhanced or non-enhanced. This algorithmic approach would help in narrowing the differential diagnosis in clinical setting faster, however the clinical correlation would be necessary. An algorithmic approach has been previously proposed for white matter disorders in children [2]. In addition to their algorithm, we considered other lesioned features, whether the pattern of distribution is symmetrical or asymmetrical and if they are enhancing or non-enhancing.

Imaging of the nervous system provides strong clues and guidelines for clinical diagnosis. In addition, clinical correlation of WMH on MRI would be necessary for an accurate diagnosis. These algorithms could facilitate fast and more accurate diagnosis in white matter disorders in clinical setting.

Conclusion

White matter diseases represents a wide area in neurology due to misdiagnosis. In white matter disease clinical findings and their correlation to MRI lesions pattern are the best way to decision making in diagnosis. Our aim is to demonstrate an algorithmic approach in imaging findings that provide us clues for better, faster and specific diagnosis that could reduce unnecessary evaluations.

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