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Opinion

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Role of Magnetic Resonance Imaging in White Matter Diseases

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Introduction

White matter diseases are a group of disorders that share the disruption of normal myelination, either as a result of subsequent degradation of previously myelinated structures (demyelinating processes) or as a result of basic myelin production defects (demyelinating processes). Many white matter illnesses have a poorly known etiology. This review will focus on demyelinating illnesses, which will be categorised into autoimmune, infectious, vascular, and toxic-metabolic mechanisms. Multiple sclerosis and related disorders, such as tumefactive demyelinating lesions, Balo concentric sclerosis, Marburg and Schilder variations, neuromyelitis optica (Devic disease), acute disseminated encephalomyelitis, and acute hemorrhagic leukoencephalopathy, are examples of autoimmune processes (Hurst disease). Lyme disease (neuroborreliosis), progressive multifocal leukoencephalopathy, and other infectious diseases. Lyme disease (neuroborreliosis), progressive multifocal leukoencephalopathy, and human immunodeficiency virus (HIV) encephalopathy are all infectious processes. Arteriolosclerosis, cerebral amyloid angiopathy, cerebral autosomal-dominant arteriopathy with subcortical infarcts, and leukoencephalopathy are examples of vascular processes (CADASIL). Arteriolosclerosis, cerebral amyloid angiopathy, cerebral autosomal-dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL), and primary angiitis of the central nervous system, Susac syndrome, and neurolupus are some of the conditions that can affect the central nervous system. Osmotic myelinolysis, methotrexate leukoencephalopathy, and posterior reversible encephalopathy syndrome are examples of toxic-metabolic processes [1]. Small multifocal white matter lesions to confluent or severe white matter involvement can all be shown on imaging. Comprehending the pathologic substrate is critical for understanding radiologic manifestations, and a systematic approach to radiologic findings in conjunction with clinical and laboratory data is essential for narrowing the differential diagnosis. White matter illnesses impair the normal myelination pattern and comprise a wide range of congenital and acquired conditions. Demyelinating (secondary degradation of normal myelin) and demyelinating (initial abnormalities of myelin production) processes can be distinguished. Demyelinating illnesses are categorised into four categories: autoimmune, infectious, vascular, and toxic-metabolic.

According to their cause, demyelinating processes are generally divided into primary and secondary categories. Multiple sclerosis is the paradigm for primary demyelinating illnesses, which have an unexplained aetiology (MS). There are several known causes of secondary demyelinating disorders. Damage to the myelin or the cells that generate the myelin, the oligodendrocyte, is the underlying condition of all demyelinating illnesses, regardless of the source. Using radiologic-pathologic connection, this review investigates the clinic pathophysiology of white matter demyelinating diseases. Neurons and glial cells make up the central nervous system. The fundamental components of normal white matter are myelinated axons and glial cells. Oligodendrocyte creates the myelin sheath, which is responsible for the colour and imaging features of normal white matter. Myelin has a water content of around 40%, while the dry half (60%) is mostly made up of lipids (70–85%), with a lesser percentage of proteins (15–30%). The lipid-to-protein ratio of spinal cord myelin is considerably higher than that of the brain. Cerebrosides and lecithin are the main lipid components of myelin, whereas proteolipid protein and myelin basic protein are the main protein elements, both of which are more unique to the central nervous system and may act as antigenic targets in autoimmune processes [2]. Myelin oligodendrocyte glycoprotein, which is involved in the creation and maintenance of myelin sheaths and is found in the outermost layer of myelin, is another key protein component that could be a target for autoimmunity. MS and associated disorders, such as tumefactive demyelinating lesions (TDLs), Balo concentric sclerosis, Marburg and Schilder variations, and neuromyelitis optica, are multiphasic autoimmune entities (NMO). Acute disseminated encephalomyelitis (ADEM) and its more violent version, acute hemorrhagic leukoencephalitis or leukoencepha, are monophasic autoimmune diseases. MS and associated disorders, such as tumefactive demyelinating lesions (TDLs), Balo concentric sclerosis, Marburg and Schilder variations, and neuromyelitis optica, are multiphasic autoimmune entities (NMO). Acute disseminated encephalomyelitis (ADEM) and its more violent version, acute hemorrhagic leukoencephalitis or leukoencepha, are monophasic autoimmune diseases.

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