Immunohistochemical Characterization of Multiple Sclerosis Plaques in Human Brain

S. O. AHMAD1, J. BAUN2, B. TIPTON2, C. ZURHELLEN2, C. SEGOVIA2, R. C. SWITZER III2

1St. Louis University, St. Louis, MO; 2NeuroScience Associates, Knoxville, TN

ABSTRACT

Multiple Sclerosis (MS) is a demyelinating disease with a complex pathological profile that includes myelin degeneration, neuronal damage, and immune cell infiltration in the areas containing plaques. We evaluated the pathology associated with MS in the brain of a 39 year old female whose cause of death was unrelated to the disease. In acute plaques the amino cupric silver method (de Olmos) revealed a dense core of degenerating nerve cells and fibers. Chronic lesions had little staining of cells or fibers and were devoid of staining by the Nissl counterstain, Neutral Red. Another silver stain, the silver nucleolar stain (AgNOR) was developed to reveal the nucleolar organizing regions in cancerous cells. We utilized the stain here to reveal the differences in interior cellularity between acute and chronic plaques. This is useful in getting accurate counts of the cell populations present in brain regions undergoing demyelination, and has proven to be a useful tool for stereological purposes. Weil-Myelin staining revealed roughly spherical plaques devoid of myelin staining. Nissl staining with Thionine distinguished acute and chronic lesions. Acute lesions appeared to be surrounded by a dense band of cells while the interior of the plaque had a normal distribution of cells. In chronic lesions the core was much lighter suggesting a loss of cells. The Perls iron stain revealed a paucity of staining in acute lesions. Chronic lesions were surrounded by iron positive cells, some of which appeared to be phagocytic and filled with debris. Iba-1 immunoreactivity in acute plaques was observed both in the center of the plaque and in a dense ring of immunoreactive microglia surrounding the plaque. In chronic lesions the central immunoreactivity was diminished, but the ring of cells surrounding the plaque appeared thicker and more dense. Staining of near adjacent sets of serial sections reveals the chemocarchitectural differences between acute and chronic states in MS lesions.

CONCLUSIONS

Anatomical comparison of near adjacent tissue sections with different IHC and classical stains is important in determining the progression and composition of disease states. In a general comparison of chronic and acute MS lesions some comparisons can be made as seen in the "Lesions" portion of this poster. The lack of cellularity and myelin in chronic lesions leads one to believe that lesions in this state are perhaps beyond immune repair. The density of staining in acute lesions might suggest that the immune response could be stopped or reversed, leading to remyelination and cellular repair. Further investigation into the autoimmune components of MS may point to possible new pathways into the remediation of MS and its symptoms.