Radiation induced Wallerian degeneration of corticospinal tract in a case of brain tumour

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Wallerian degeneration is antegrade degeneration that occurs distal to point of injury. Here we present a case of a 50 years old man, diagnosed as Astrocytoma grade II and IDH muted right frontal lobe, underwent surgical debulking of tumour followed by radiotherapy. After 1 year of radiation he developed left sided body weakness. MRI was performed that revealed linear T2/FLAIR hyperintense signals extending from centrum semiovale along the posterior limb of internal capsule to the cerebral peduncle reaching upto the pons consistent with radiation induced Wallerian degeneration.

Discussion

Wallerian degeneration is cascade of catabolic biochemical events mediated by innate immune response to neuron injury. It is also called as orthograde or antegrade degeneration as this process is directed away from cell body. It is named after the English neurophysiologist Augustus Volney Waller (1816-1870), who described the process in 1850.\(^1\) The insult to neuron can be due to various etiologies like brain infarction, haemorrhage, necrosis, demyelination, trauma, tumour, radiation or chemical. This catabolic process occurs in four steps and is mediated by invasion of series of macrophages, cytokines and activated Schwann cells. It is usually classified into four stages. The first stage involves degeneration of the axons and myelin sheaths with recruitment of macrophages and release of tumour necrosis factors and interleukins (0-4 weeks). In the second stage there is rapid destruction of degenerated myelin protein fragments while lipids remain intact (4-14 weeks). Third, myelin lipid degeneration results in gliosis (>14 weeks). In the end stage there is atrophy of the white matter tracts (occurs in months to years). The small nerve fibers have capability to regenerate at severed ends and joins proximal end.\(^1\)

Radiology has a key role in early detection and prevention of progression. On CT scan it appears as hypodensity along corticospinal tract pathway. MRI is important in early diagnosis, evaluating pathophysiologial and chemical changes. On MRT2W images show hypointense band in initial 10-14 days due to increase lipid content of myelin sheath and after 4 weeks signals turn to hyperintense.\(^2\)

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Figure: (A) axial FLAIR MRI image shows post- surgical gliosis and bilateral para-sagittal hyperintense oedema. (B) Coronal FLAIR MRI image shows linear hyperintense signals in posterior limb of right internal capsule. (C) Coronal FLAIR MRI image shows linear hyperintense signals along course of corticospinal tract in cerebral peduncle, midbrain, pons and medulla.
In our case MRI FLAIR images demonstrated linear hyperintense band along path of right corticospinal tract extending from internal capsule to brain stem. This represents chronic nature and was induced by radiation to right frontal lobe tumour.

The purpose of this case is to highlight the fact that this is one of the causes in deterioration of patient's condition in post therapy state. This should be considered while evaluating worsening patient symptoms with brain tumour in addition to tumour extension or therapy complications.

References
