Red Nucleus

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Introduction

In progression of Vertebrates locomotion prototype has got an important and substantial role. Lateral appendages of marine antecedent converted into adjuncts responsible for bipedal gait[1]. Initially quadrupeds and then bipeds used their extremities by the co-ordination of Central Nervous system for the desired movements for locomotion, survival and for the search of food and shelter. The red nucleus is not red but is insipid pink; the color is owed to its iron content, which is in two diverse forms as hemoglobin and ferritin.

Here the role of red nucleus is crucial in regard to the concerned descending pathways. The constitution of this rubral collection has altered significantly in the development of mammals. Neurons of the red nucleus can be classified in accordance with their size. In general it is observed that the largest sized neurons are prevalent in the tail end whereas others are dispersed in central and anterior end[2]. In the connectivity of the red nucleus in terrestrial vertebrates, stages and extent of involvedness can be notable, by the cerebellar expansion and growth. These stages of association are most likely allied to the type of motor presentation in the particular terrestrial vertebrates[3].

It was made evident by various workers that red nucleus in mammals exhibited massive cells in its magnocellular part, while intermediate and petite ones in parvocellular part of red nucleus[4].

The red nucleus is situated in the tegmentum part of the midbrain lying adjacent to the substantia nigra. Both of these as subcortical centres are actually the important constituents of the extrapyramidal motor system.

These massive cells in the red nucleus – magnocellular part, were primarily the source of the contralateral outcropping of the rubrospinal tract prominent in early vertebrates[1]. Various studies in humans illustrate an augmented growth of the parvicellular part of red nucleus. In human it is to be noted that (magnocellular part) and (Parvicellular part) are entirely autonomous entities[5]. Stimulus of the corticospinal and rubrospinal pathways when observed physiologically, put forth analogous exhibition on motor neurons, reflex pathways to them and interneurons as well[6]. Lately comprehensions revealed that collaterals of these pathways congregate on general propriospinal neurons with undeviating straight excitatory relay to the forelimb motor neurons[7]. The rubrospinal tract is crossed where as rubro-olivary tract is uncrossed.

The preponderance of axons of red nucleus hardly relay to the spinal cord. As an alternative, that too its parvocellular part, convey information from the motor cortex to the cerebellum. Here role of inferior olivary mass or nucleus in medulla is crucial as it is a vital relay center.

The involvement of the rubrospinal tract in the organization and execution of distal movements is in agreement with further physiological and anatomical facts. Neurons of red nucleus get afferents from provinces of the motor cortex which directs whole limb muscles[8]. The rubrospinal tract is acknowledged to assist mainly the flexor muscles of the upper limb[9].

Furthermore a trivial prompt within the red nucleus has shown the subsistence of comparatively separate region, from which contraction of all individual muscles of the contralateral limbs could be induced. Injury of the red nucleus in animals as cat has shown the impediment with the movements followed by indications as dysmetria and distorted activities of distal muscles[10]. The extent of indications was directly proportion to the degree of damage in red nucleus of contralateral side. Even slightest damage in the red nucleus produces little manifestation and shorter lasting deficits.

Disruption of the rubro-olivary tract leads to myoclonic movements. Neuronal activity of red nucleus in Parkinson disease is augmented during passive and intentional movements[11]. Functional imaging have revealed that red nucleus activation are associated with motor performance with

intricate sensory discrimination, evident speech assembly, pain associated complications, along with restricted correlation during simple movements. A lesion of the red nucleus causes motor dysfunctions as undeliberate tremor, atypical muscle tone and choreo - athetosis.

The bulk of inputs to red nucleus are from the contralateral region of the cerebellum and ipsilateral cerebral motor cortex. In humans, the greater part of the output goes to the bundle of fibers pass through the medial tegmental field toward the ipsilateral inferior olivary nuclear complex in medulla oblongata, to constitute the pathway that eventually controls and persuades the cerebellum. Second output that is through the rubrospinal tract which reaches the contralateral reticular formation in the hindbrain and spinal cord, forming the rubrospinal tract. Its notes worthy that the rubrospinal tract has considerable role in non-primate order which is substituted by corticospinal tract in their counterparts.

It is believed that in the human, well-developed parvicellular red nucleus is estranged from the medial accessory nucleus of Bechterew (NB), present in the ventral central gray matter. Besides here it is also found to be scattered over dorsomedial division of the red nucleus. It is found to be originated from medial tegmental tract which in due course get shifted finally to the contiguous reticular formation. This severance of the medial accessory nucleus of Bechterew (NB) and the nucleus of Darkschewitsch along with the translocation of the location of the medial accessory nucleus of Bechterew (NB), in a view is the aftermath within the ancestry of the apes preceding the surfacing of man. In addition it is also a firm belief that the rudimentary human magnocellular red nucleus part consists of a scattered assemblage of large sized neurons located amongst the fibers of the superior cerebellar peduncle. In early days the magnocellular part of red nucleus was never considered as an independent unit. But with innovations, nowadays a demarcation of the rudimentary human magnocellular part through various proposed concepts as Mannen's closed nucleus and Ogawa's human magnocellular red nucleus. Presence of semilunar magnocellular red nucleus in intrauterine life fortifies the perception of role of bipedalism in hominoids with considerable rubrospinal tract. It is found that in vertebrates, with no considerable corticospinal tract, red nucleus is responsible for carrying out normal gait. Meanwhile if the aforementioned tract is not considerable the red nucleus becomes vestigial.

The remarkable human prefrontal, NB, olivary and lateral cerebellar course is said to be the cause of materialization of words and verbal communication[12].

Essentials on the stimulation and propagation of the parvocellular part of red nucleus in tactile discrimination activities confirm it as a sensory entity. Contemporary deliberation recognizes the function of the red nucleus being concerned with intended limb movements. Novel concepts ways around the ideology of activation patterns of parvocellular to be resultant of the movement itself, or in other terms dependent on the utilization of the region in extremity in demonstrative sensory data possession[13]. In spite of details available, much work is still expected to understand this rubral mass. Red nucleus is an important part of the extrapyramidal system and its connections are being studied, revaluated and discussed in more details as there are more advancement in neuronal tracing techniques.

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