

**Research Article**

## **HISTOMORPHOGENESIS OF FULLTERM FOETAL NUCLEUS PROPRIUS OF SPINAL CORD**

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### **ABSTRACT**

The centre for perception of all sensory modalities is the dorsal horn of the grey matter of spinal cord. In mammals including man six laminae were designated by Rexed. The literature available on cytoarchitecture nucleus proprius of the dorsal horn of spinal cord is restricted to mammals other than man. The present study is an attempt to observe histomorphometry of neurons of nucleus proprius of cervical segment of spinal cord, numerical density and population study of nucleus proprius. The spinal cord of a destitute full term foetus has been dissected and processed for light microscopic study. Holme's silver nitrate staining was done for all sections. Nucleus proprius was found to be bulbous. There is a difference between right and left nucleus proprius in as far as morphometry, numerical density and population study.

**Key Words:** *Nucleus Proprius, Substantia Gelatinosa Rolando, Quantitative Study, Morphometric Study And Population Study*

### **INTRODUCTION**

The cell dynamic of dorsal horn of grey matter is to be understood by the quantitative and the population studies. The morphometric analysis of nucleus proprius of cervical segment of human spinal cord at the full term is being undertaken in the present study. The study involved the measurement of cell dimensions by applying stereological principle to microanatomy (Meyhew, 1983). Abercrombie (1946) applied these principles to understand morphometric study and revolutionize this field. Histomorphometry of nucleus proprius in rat lumbar spinal cord was studied by Bharadwaj *et al.*, (2001) is available. However the cytoarchitecture of human foetal dorsal horn of spinal cord has not been traced in the literature. The cytoarchitecture of dorsal horn in macaque (Ralston, 1979), in cat (Ralston, 1982) and also in pigeon (Leonard, 1975) is available. An attempt is made to study the cytoarchitecture of nucleus proprius of human foetal spinal cord with reference to histomorphometry, numerical density and population study.

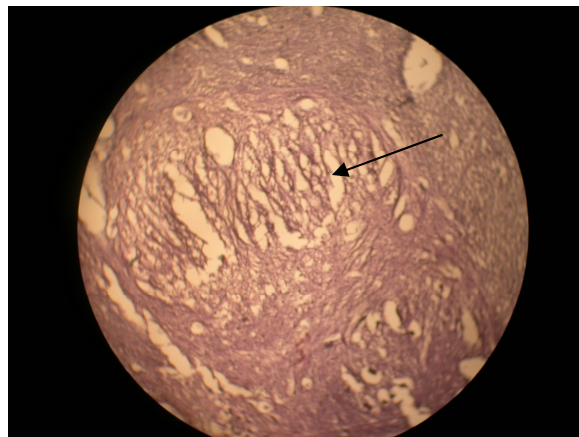
### **MATERIALS AND METHODS**

One full term destitute male foetus available in the department of anatomy MIMS medical collage is the study material. The foetus has been perfused with 10% formalin as per the protocol. After 72 hours laminectomy was done and the spinal cord was exposed. Cervical segment was identified and 1mm thick cervical spinal cord segment was processed for light microscopic study. Five microns thick sections were taken and stained with H and E, and Holme's silver nitrate stain for identification of the tract cells of nucleus proprius. Morphometric studies as well as population studies have been done. The nucleus proprius constituted rounded and spindle shaped neurons. After going through all the sections, the length and breadth of nucleus proprius was calculated by using stage and eye piece micrometer. The volume was calculated by  $ab^2 \pi/6$  of the physics formula. The formula advocated by Salim and Krishna Murthy i.e. number of cells per cubic mm X total volume of the nucleus = total number of cells in the nucleus proprius was used.

### **RESULTS**

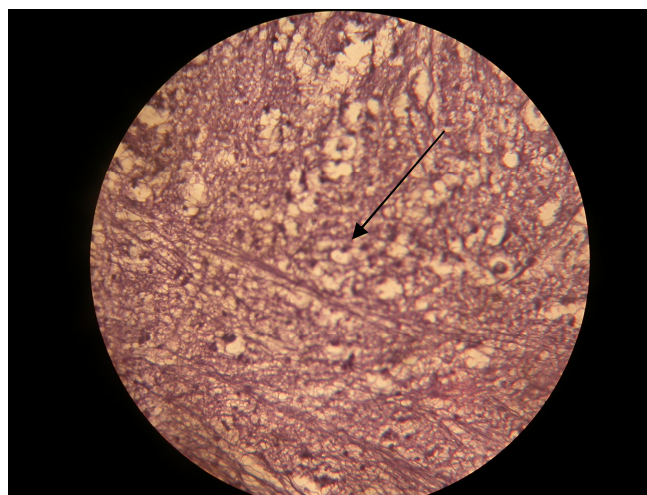
The nucleus proprius is identified as bulbous expansion of dorsal horn of spinal cord of cervical segment (Fig 1).

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**Figure 1: Showing Nucleus Proprius,10x10,Holmes Silver Nitrate**

It consists of tract cells and interneurons. Above the nucleus proprius substantia gelatinosa of Rolando occupied apex of dorsal horn having small rounded neurons. Measurements of nucleus proprius were taken, average breadth on right side is 1043.75 microns where as on left side 1037.5 microns, which shows a marginal difference in breadth. Average length on right side is 693.75 microns where as on left side it is 681.25 microns. The volume of nucleus proprius is calculated with the formula of  $ab^2 \pi/6$  (a=length, b= breadth  $\pi=0.52$ ) The volume of nucleus proprius on right side is 0.281677cubic mm where as on left side it is 0.26325cubic mm. The nucleus has large and small round neurons which are uniformly dispersed (Fig 2).



**Figure 2: Showing Round Cells Of Nucleus Proprius, 10x40,Holmes Silver Nitrate**

The average length of neuron on right side is 6.71 microns (10X40 xs) where as on left side it is 6.74 microns (10X40x). Average breadth remains same hence neurons are uniformly large. Average volume of neuron on right side 157.09cubic mm where as on left side it is 159.21 cubic mm. Hence the volume of cells differ from right to left very slightly. The numerical density is calculated by using the formula  $ND=NA/D+T$ , where ND is numerical density NA is mean number of cells per reticule, D is the mean diameter and T is thickness of section (Weibel(1979)and Sheriff(1953). Thickness of section is 5microns. The numerical density on right side is 2625936 on left side it is 2132052(table1).

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**Table 1 Showing Morphometry Of Neurons Of Nucleus Proprius**

Nucleus proprius	Average length	Average Breadth	Average Volume	Average No of cells per reticule	Numerical density
Right	6.71 microns	6.71 microns	157.09 cubic microns	17.62	2920750
Left	5.575 microns	5.575 microns	159.21 cubic microns	14.37	2647063

The population study of nucleus proprius revealed 739647 on right side 561262 on left side (table2)

**Table 2: Showing Population Study Of Nucleus Proprius**

Nucleus proprius	Average Length	Average Breadth	Volume	Population = Numerical Density x volume
Right	668.75 microns	900 microns	0.281677 millimeter cube	739647
Left	625 microns	900 microns	0.26325 millimeter cube	561262

**DISCUSSION**

Histomorphometry of nucleus proprius has been studied by Bhardwaj *et al.*, (2001) in rat lumbar dorsal horn of spinal cord. In rat the nucleus proprius could be divided into a dorsal part having smaller neurons and broader ventral part containing loosely dispersed neurons. Rexed and Ralston 1979 designated the apex of dorsal horn as substantia gelatinosa and designated it as lamina II. Schizogonthai, J 1964 and Scheibel, & Scheibel, 1964 could not differentiate lamina II & lamina III in rats and consolidated the 2 zones. The neurons of dorsal division are small and densely packed. Spindle cells also dominated lamina II. Rounded cells constituted the second cell type having 23.18% of total cell population. In the ventral part of nucleus proprius, spindle cells dominated constituting 57.15% of total population, whereas rounded cells contributed 42.5%. Beal & Cooper 1978 and Ralston 1979 revealed similar findings in the spinal cord of monkey. In the present study nucleus proprius of full term human foetal spinal cord of cervical segment the nucleus proprius could not be differentiated into dorsal and ventral parts. The nucleus proprius is dominated by rounded cell. A difference of cell dimension numerical density and population study was observed between left and right sides. The observations of present study are of significant value when compared with other works in mammals. No similar study has been made earlier as per the present available literature reveals.

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