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Gross and histoarchitecture of glycogen body in domestic fowl (*Gallus domesticus*)

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Abstract

Glycogen body (*Corpus gelatinosum*) was observed in the lumbosacral region (Synsacrum) as oval shaped transparent jelly like structure. It was observed in the rhomboid sinus of the spinal cord at the level of L4 –S2 region. Histologically, glycogen body divided into dorsal and ventral parts. The ventral part enclosed the central canal of the spinal cord. Dorsal part of the glycogen body was highly vascularised in the central portion and no connective tissues were detected except in the vicinity of blood vessels. The cells of the glycogen body in the dorsal part were closely packed with irregular polygonal cells. In the ventral part, cells were loosely arranged. Cells of Glycogen body showed moderate PAS positive reaction. However, high PAS positive reaction was observed in the periphery of the cells in the cytoplasm with peripherally located basophilic nucleus. There were a series of comparatively very small and less conspicuous accessory lobes of Lachi.

Keywords: glycogen body, fowl, lobes of lachi

1. Introduction

The avian glycogen body is located on the dorsum of the lumbosacral segment of spinal cord between L4-S2. It is said to be originated from the bilateral clusters of cells in the roof plate of the lumbosacral spinal cord [19]. The glycogen body is formed by large, round-to-oval cells which seem irregularly polygonal because of their proximity.

The microscopic structure of the glycogen body has been described in chicken [18, 1, 6, 14] Japanese quail [3], Pigeon [15] Turkey [17] and different species of wild birds [12]. Each cell of the glycogen body contains a peripheral cytoplasmic frame encircling a centrally positioned glycogen mass and peripherally located nucleus. The nuclei are mainly elongated, with irregular edges and lobular in shape in pigeon [15]. The connective tissue is not detected except in the vicinity of the blood vessels. There is no connection between the ventral aspect of the glycogen body to the spinal cord. Glycogen body is made of astroglial cells and cytoplasm of these cells shows the glycogen droplets.

2. Materials and Methods

Vertebral column regions of six adult broilers from the thoracic region to the end of the synsacrum were collected from the retail chicken shops in and around Vepery, Chennai. The vertebral column was dissected out and the spinal cord was taken with intact meninges and glycogen body was located. Gross morphology of the organ was observed with the naked eye and morphometrical data was recorded and analysed. The tissue pieces of the organ was fixed in different fixatives (10% NBF, Bouin's and Carnoy's) and processed for routine paraffin embedding. The paraffin sections were cut into 5-6 µm thickness and subjected for routine, special and histochemical staining techniques viz., Haematoxylin and eosin (H&E) stain for routine histological observation, Picrosirius red stain for connective tissue stain, Periodic acid- Schiff (PAS) stain for the demonstration of glycoprotein (neutral mucosubstances) and Toulidine blue for metachromasia [8].

3. Results and Discussion**3.1 Gross Observations**

In the present work, it was found in the L4 to S2 region of the spinal cord. Whereas, In present study, dissection of the lumbosacral region (Synsacrum) revealed that glycogen body was a egg/ovoid mass transparent jelly like structure in the rhomboid sinus of spinal cord at the level of L4 –S2 region (Fig.1). This observation was in agreement with the reports in domestic

chicken [9, 19, 5, 10]. But, Glycogen body extended throughout the length of the spinal cord of chicken [16]. It was a separate structure and upon removal there was no injury occurred to the spinal cord. At the level of L6, it was in maximum size and cranially (L4) and caudally (S2) tapered in shape. These observations were similar to the findings [5] in chicken. Piamater covered the cranial, caudal and dorsal surfaces of the glycogen body. But, the ventral surface was not covered by piamater. Dorsal surfaces of the glycogen body was convex and ventral surface was less convex. These findings concurred with the opinion of [5, 10] in chicken.

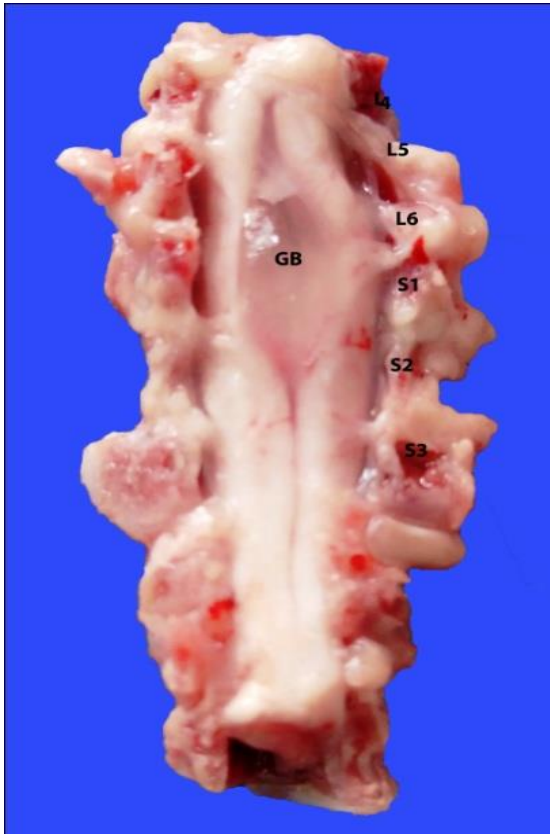


Fig 1: Photograph showing the location of the glycogen body (GB) in between L4-S2 of the spinal cord.

Gross morphological measurements of glycogen bodies namely length, width and thickness were 1.68 ± 0.24 cm, 1.08 ± 0.24 cm and 0.85 ± 0.13 cm respectively (Mean \pm SD). these findings on aforesaid parameters were not reported in the available literature.

3.2 Histological and histochemical observations

Histologically, glycogen body was divided into dorsal and ventral parts (Fig. 2). The ventral part enclosed the central canal of spinal cord. Similar findings were reported by Ebraheim [5] in chicken. In chicken, dorsal and lateral part of the glycogen body was covered by the piamater but ventrally, the piamater was not observed. These observations concurred with the results of [4, 5] in chicken. Collagen fibres were present in the piamater and also in the vicinity of the blood vessels (Fig. 3). Dorsal part of the glycogen body was highly vascularised in the central portion and no connective tissue were detected except in the vicinity of the blood vessels (Fig. 4). These observations were concurred with the findings of [11, 5] in chicken.

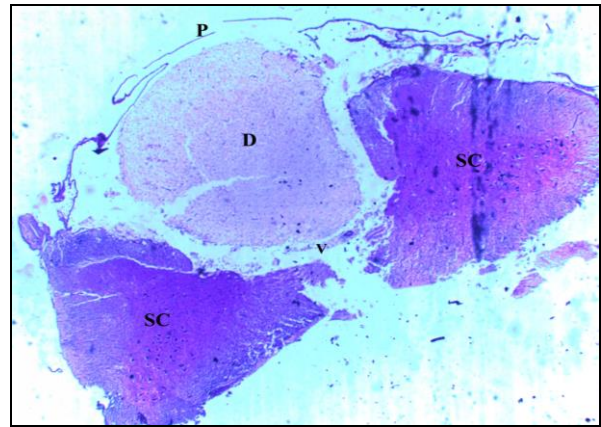


Fig 2: Photomicrograph showing glycogen body which was located dorsal to the spinal cord and divided into dorsal (D) and ventral (V) parts. SC-Spinal cord P-Piamater H&E x 12.5

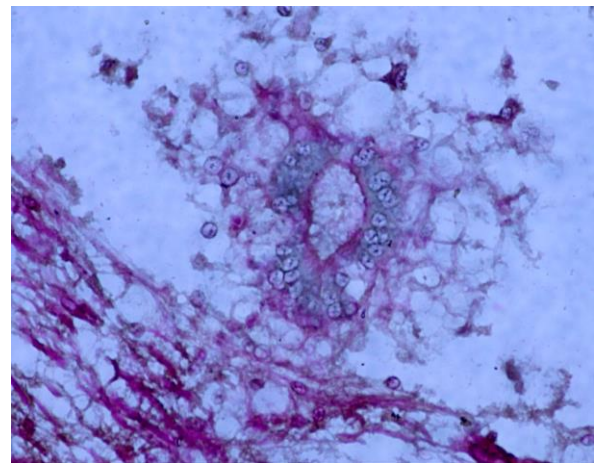


Fig 3: Photomicrograph showing connective tissue fibres (arrows) in the subependymal region of the central canal. Picrosirius red x 400

The cells of the glycogen body in the dorsal part were closely packed with irregular polygonal cells. These cells had a narrow cytoplasmic rim and nucleus was located to the edge or periphery of the cells. The shape of the nucleus was irregularly triangular or round with a centrally placed round nucleoli (Fig. 5). Similar findings were reported by [5, 9].

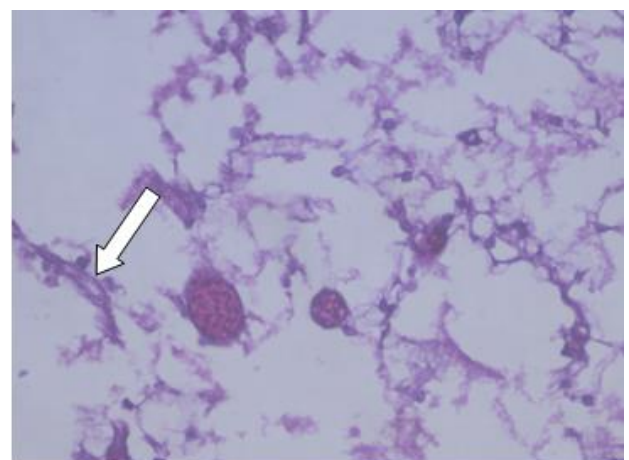


Fig 4: Dorsal part of the glycogen body showing blood vessels (arrow). H&E x 400

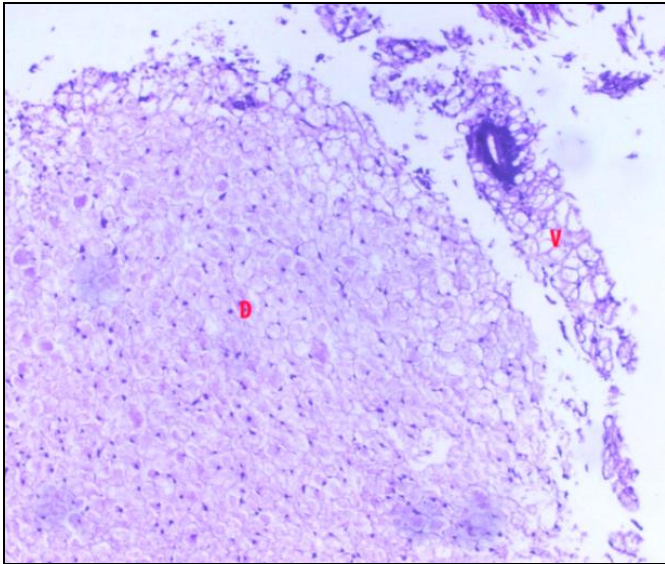


Fig 5: Photomicrograph showing arrangement of cells and their morphology in dorsal (D) and ventral (V) part of glycogen body. H&E x 100

Central canal of the spinal cord was surrounded by the ventral part of the glycogen body and was lined by the ciliated columnar epithelium. In the ventral part, cells are loosely arranged. The cells were polygonal in shape with narrow cytoplasmic rim. The nucleus of these cells was round in shape with centrally located round nucleolus. In between these cells, blood vessels with blood cells were observed. Connective tissue was not present except at the vicinity of the blood vessels and at the region surrounding the central canal. These finding were similar to the observation of [5].

Glycogen body cells had a moderate PAS positive reaction. However, relatively PAS intense positive reaction was observed in the periphery of the cells when compared to the central portion (Fig. 6). The glycogen body cells were large and regularly arranged with metachromatic areas in the cytoplasm with peripherally located basophilic nuclei (Fig. 7). These results concurred with the finding of [5] in chicken.

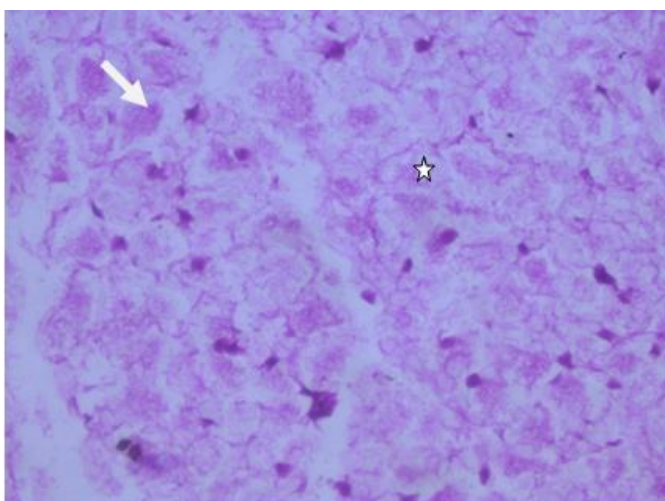


Fig 6: Photomicrograph showing moderate PAS positive reaction(*) in the central portion and high PAS positive reaction (arrow) in the periphery of the dorsal part of glycogen body. PAS x 400

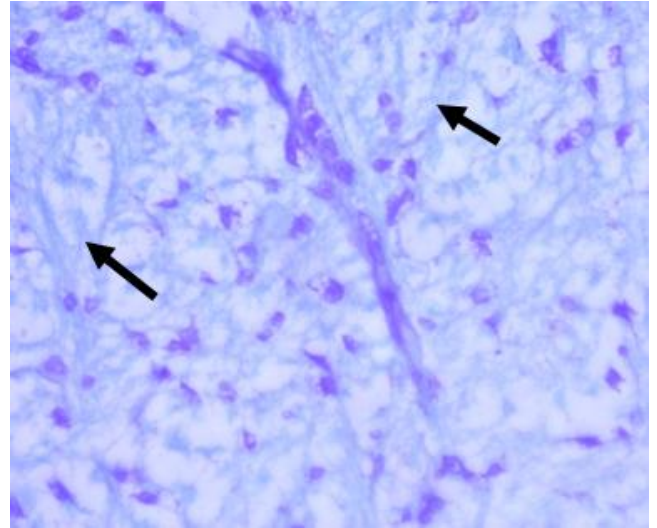


Fig 7: Photomicrograph showing metachromatia areas (arrows) in the cytoplasm with peripherally located basophilic nucleus. TB x 400

There were a series of comparatively very small and therefore less conspicuous accessory lobes of Lachi, lied along the proximal portion of ventral motor routes of spinal nerves 19 to 29. Both glycogen body and lobes of Lachi are made up of astroglial cells which possess large quantities of glycogen. These lobes were located dorsal to the lateral longitudinal or dentate ligament (Fig. 8). The lobes consisted of a number of medium-sized multipolar neurons, myelinated and unmyelinated axons, glycogen cells, glial cells, and capillaries. These observations were concurred with the reports in the pigeon [13]. Both glycogen body and lobes of Lachi are made up of astroglial cells which possess large quantities of glycogen [2, 7].

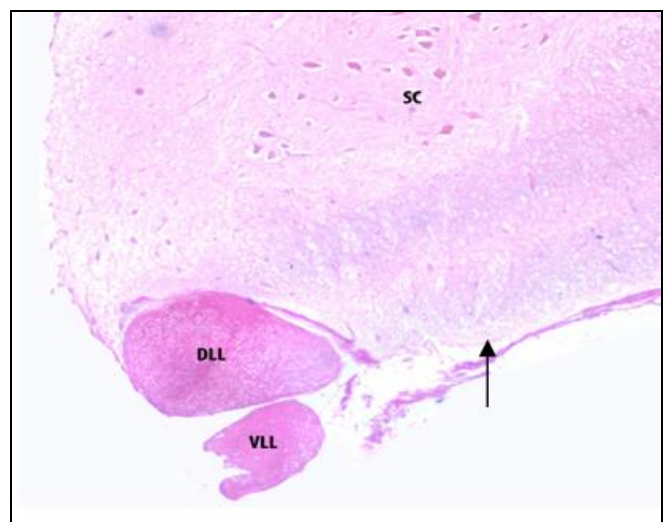


Fig 8: Photomicrograph showing dorsal (DLL) and ventral lobes (VLL) of Lachi. Ligamentum denticulatum (arrow) SC-Spinal cord Picrosirius red x 400

4. Conclusion

In broiler chicken Glycogen body (*Corpus gelatinosum*) was noticed as egg/ovoid mass transparent jelly like structure in the rhomboid sinus of spinal cord at the level of L4 –S2 region. Glycogen body had dorsal and ventral parts. The

glycogen body cells in the dorsal part were irregularly polygonal with the nucleus pushed toward one edge of the cells. Cells in the ventral part were loosely arranged and polygonal in shape with narrow a cytoplasmic rim. These cells were modified astroglial cells. Glycogen body was the unique feature of the avian species evolved as a nutritive reserve to provide a margin of safety for the metabolic source of the central nervous system in birds. It may play a role in the myelin formation within the central nervous system. It can be concluded that the histophysiological relationship of the glycogen body is still a mystery hoping that the incoming research can solve it.

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