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THE ARTERIAL VASCULATURE OF THE LUMBO-SACRAL ENLARGEMENT OF THE SPINAL CORD IN DUCK, PIGEON AND CHICKEN

(With 6 Figuers)

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المدد الدموى الشريانى للتضخم القطنى العجزى فى البط والحمام والفراخ

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يتم المدد الدموى الشريانى لفلقات النخاع الشوكى المكونه للتضخم القطنى العجزى فى كل من البط الحمام والفراخ من خلال الاوعيه الدمويه الشوكيه التى تنشأ بانتظام من الشريان الاورطى الهابط فى كل من المنطقه القطنيه والعجزيه . فى الطيور يتميز الجزء القطنى العجزى من النخاع الشوكى بوجود الحفره المعينه والتى تحتوى على الجسم الكربوهيدراتى ولذلك فان نموذج توزيع الاوعيه الدمويه فى هذه المنطقه تختلف عن مثيلتها على امتداد النخاع .

SUMMARY

The spinal cord segments forming the lumbosacral enlargement in duck, pigeon and chicken are vascularized by the segmental spinal branches which originate regularly from the lumbar and sacral arteries of the descending aorta. The lumbosacral part of the spinal cord of birds is characterized by the presence of the Fossa rhomboidalis spinalis which contains the Corpus gelatinosum. The pattern of arterial distribution at the level of the sinus rhomboidalis differ from that found elsewhere in the spinal cord.

Keywords: *Arterial vasculature, lumbo sacral enlargement, spinal cord, duck, pigeon, chicken.*

INTRODUCTION

The arterial vasculature of the lumbosacral enlargement of chicken was described briefly by *STRRERZI (1904), KITOH (1963) and LOB (1967)*. The arterial vasculature of the spinal cord segments forming the cervical enlargement in chicken, pigeon and duck was examined and described in details by *HASOUNA (1990)*.

This work aims to spot light on the pattern of arterial distribution in the

segments forming the lumbosacral enlargement in pigeon, duck and chicken.

MATERIAL AND METHODS

Twenty adult healthy birds of both sexes from each species were chosen. The birds were defeathered and injected intra-venously with 1-1.5 ml. heparin (5.000 I.U./ml). After about 30 minutes each bird was anaesthetized with chloroform inhalation, fixed and abdominal cavity was opened. A specific canula {18 G (1.3 mm x 51 mm)} was inserted into the cavity of the left ventricle followed by a small incision in the wing vein to insure complete bleeding of the bird. The birds were then injected with a mixture of 1.5:1 serum-indian ink till the vessels of the abdominal viscera, tongue and the arterioles of the skin, sclera and comb become black and well injected. The injected birds were fixed in 10% formalin for a night then the vertebral columns were removed and immersed in 10% formalin for 7-10 days. The specimens were then subjected to a process of declacification in a saturated sodium chloride solution and concentrated hydrochloric acid (1ml for each 100 ml NaCl). For succesful completion of the decalcification process a daily addition of 1 ml conc. HCl was found to be necessary. The spinal cords were then dissected out of the vertebral canals and preserved in 10% formalin for 5-7 days then examined and photographed.

RESULTS

The arterial blood supply of the lumbosacral part of the spinal cord is derived from the spinal branches of the bilateral segmentally arranged lumar and sacral arteries which originate from the descending aorta in the region of the synsacrum. Each spinal branch divides into a smaller dorsal radicular and a larger ventral radicular arteries.

The dorsal radicular arteries are responsible for the vasculature of the dorsolateral portion of the spinal cord and the formation of the right and left dorsolateral spinal arteries (Fig. 1/2; 2/3; 3/2). The ventral radicular arteries supply the ventrolateral portion of the spinal cord, and re-enforce the single median ventral spinal artery.

The dorsolateral spinal arteries detach numerous ventral twigs (Fig. 2/2) to form the rich lateral spinal plexus, in addition to several fine Rr. spinales dorsales (Fig 1/3; 2/5; 3/3) which share in the formation of the dorsal spinal plexus. In case of duck, the dorsal spinal branches ascend in a serpentine course to join similar branches of the other side to form the single median dorsal spinal artery which courses deeply within the dorsal median sulcus (Fig. 1/5)

At the level of the Fossa rhomboidalis spinalis (Ls2-Ls6 in pigeon, Ls3-Ls7 in duck and Ls2-Ls7 in chicken) the dor-

sal radicular arteries are well developed and each bifurcates into a dorsal and a ventral branch. The dorsal branches (Fig. 3/a) continue the course of the dorsolateral spinal artery along the lateral border of the Fossa rhomboidalis spinalis. The other ventral branches (Fig. 3/b) are responsible for the formation of the lateral spinal plexus.

The dorsolateral spinal arteries detach several fine Rr. spinales dorsales which ascend toward the lateral borders of the Fossa rhomboidalis spinalis then bend medially and ventrally on the medial wall of the dorsal funiculi to share in the vasculature of the glycogen body and its neighbouring gray matter.

The dorsal radicular arteries are ill-developed at the level of the last lumbosacral spinal segment; their smaller dorsal twigs continue the course of the faint dorsolateral spinal arteries. Their ventral branches are ill-developed in pigeon, and large screw-shaped in chicken. (Fig. 2/2).

The ventral aspect of the lumbosacral enlargement is vascularized by the ventral radicular and the ventral spinal arteries. The ventral radicular arteries are well developed in case of duck and chicken (Fig 4/1; 5/1; 6/1). Each descends along the ventral root of the corresponding spinal nerve to reach the ventral surface of the spinal cord where each divides into several branches. These branches in duck passes medially in a serpentine course to join the ventral spinal artery forming complicated irregular spinal circles (Fig. 4/3). A fine continuation of the ventrolateral spinal arteries was observed in some cases at the level of Ls_1-Ls_3 in duck (Fig. 4/4)

The ventral radicular arteries are poorly developed in case of pigeon and their branches join the ventral spinal artery to form a rather simple arterial circle (Fig. 5/3).

The branches of each ventral radicular artery in chicken anastomose with each other to form a rich arterial plexus. The branches of each plexus join the double-formed ventral spinal artery forming simple arterial circles (Fig. 6/3).

DISCUSSION

The arterial vasculature of the lumbosacral enlargement is maintained through the branches of the paired dorsolateral and the single ventral spinal arteries. These arteries are reenforced along their length by the regular segmental branches of the dorsal and ventral radicular arteries as the case in the cervical enlargement described by *HASOUNA (1990)* in chicken, pigeon and duck.

LOB (1967) noticed a discontinuous ventrolateral spinal arteries which originate from the ventral radicular arteries in the region of the lumbosacral enlargement in fowl. Similar continu-

ation of the fine ventrolateral spinal arteries was observed along the cranial segments of the lumbar cord in duck.

The irregular spinal arterial circles found at the area of union between the branches of the ventral radicular and the ventral spinal artery were also noted by *STERZI (1904), KITOH (1963) and LOB (1967)* in the lumbosacral cord of chicken. Similar circles were observed also by *AHMED (1986)* along the course of the ventral spinal artery in rabbit. These circles may have an important physiological role in regulating the pressure of the arterial blood passing into the texture of the spinal cord as stated by *AHMED (1986)*.

The dorsal portion of the lumbosacral cord is supplied by the branches of the Aa. spinales dorsolaterales as stated also by *LOB (1967) and BAUMEL (1975)*. These arteries detach Rr. spinales dorsales and ventrales. At the level of the Fossa rhomboidalis spinalis, the dorsal spinal branches bend around the dorsal funiculi and descend between the glycogen body and the medial aspect of the dorsal funiculi as stated also by *STERZI (1904) and LOB (1967)* in fowl. *LOB (1967)* mentioned that these branches (Rr. spinales dorsales) reach the floor of the Fossa rhmboidalis spinalis after descending between the nervous substance and the glycogen body. However, such level of termination was not observed in pigeon, duck or chicken, as the floor of the Fossa is vascularized by the commissural branches of the ventral spinal artery.

The ventral branches of the Aa. spinales dorsolaterales are numerous at the level of the lumbosacral enlargement than in other parts of the spinal cord and form rich arterial plexuses in chicken as stated by *STERZI (1904)*. Such rich plexuses were demonstrated also at the same level in duck.

The results of this work indicates that the lumbosacral enlargement is highly vascularized in the examined swimming and running bird species (duck and chicken) than in the flying birds.

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LEGENDS

Fig. 1: A photograph of the dorsoloteral aspect of duck spinal cord at the level of T_9-Ls_2; X-80 showing: 1. A. radicularis dorsalis, 2. A. spinalis dorsolateralis, 3. Rr. spinales dorsales, 4 lateral spinal plexus, 5 A. spinalis dorsalis 6 dorsal spinal plexus.

Fig. 2: A photograph of the dorsal aspect of chickens spinal cord at the level of T_7 - $Ls_{1,}$; X-320 showing: 1. A. radicularis dorsalis, 2. Ventral branch, 3. A. spinalis dorso-lateralis 4.Lateral spinal plexus, 5. Rr. spinales dorsales, 6. Arterial circle, 7. Dorsal spinal plexus.

Fig. 3: A photograph of the dorsal aspect of chickens spinal cord at the level of T_7 - $Ls_{6,}$; X-160 showing: 1. A. radicularis dorsalis, 2. A. spinalis dorsolateralis, 3. Rr. spinales dorsales, 4.Dorsal spinal plexus, 5. Rhomboid sinus, a: Dorsal branch, b: Ventral branch of A. Radicularis dorsalis.

Fig. 4: A photograph of the ventral aspect of duck spinal cord at the level of Ls_3-$Ls_{4,}$; X-320 showing: 1. A. radicularis ventralis, 2. A. spinalis ventralis, 3. Spinal arterial circle, 4.A.spinalis ventrolatralis.

Fig. 5: A photograph of the ventral aspect of pigeon spinal cord at the level of T_6-$Ls_{2,}$; X-80 showing:1. A. radicularis ventralis, 2. A. spinalis ventralis, 3. Spinal arterial circle.

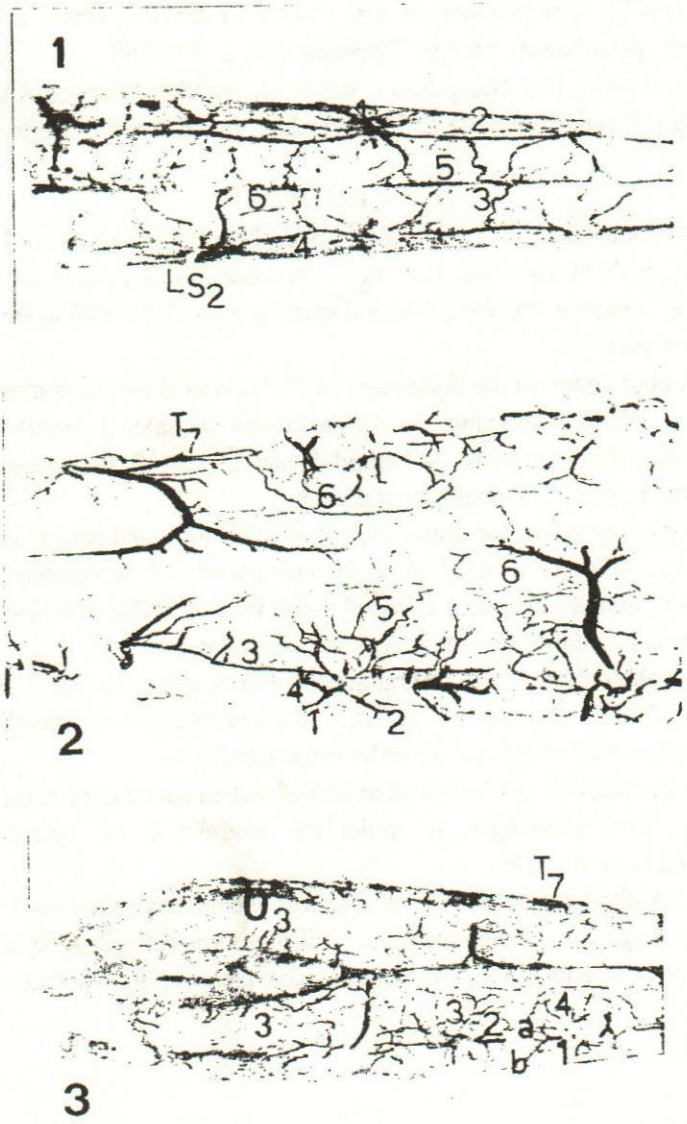
Fig. 6: A photograph of the ventral aspect of chickens spinal cord at the level of Ls_2 - $Ls_{8,}$; X-160 showing: 1. A. radicularis ventralis, 2. A. spinalis ventralis, 3. Spinal arterial circle, 4. Ventral spinal plexus, 5 poorly vascularized band.

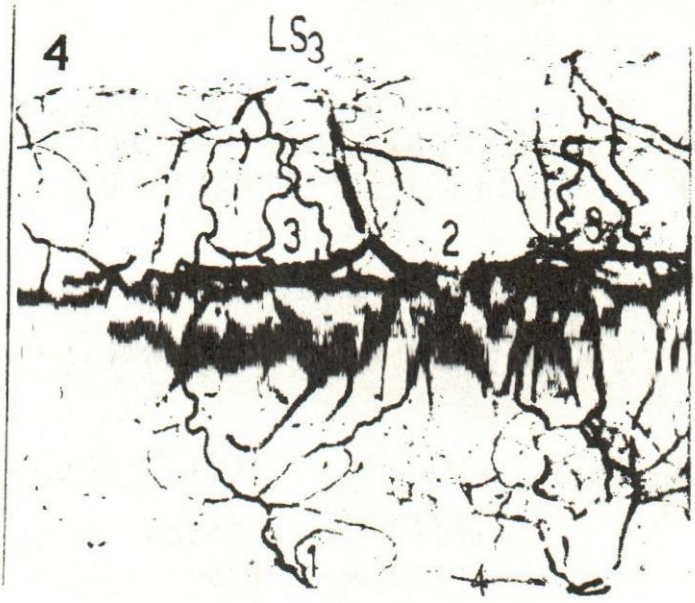
Fig. 5: Ventral aspect of T6 - Ls2, pigeon, x8.

1 A. radicularis ventralis, 2 A. spinalis ventralis, 3 spinal arterial circle.

Fig. 6: Ventral aspect of Ls2 - Ls8, chicken, x16.

1 A. radicularis ventralis, 2 A. spinalis ventralis, 3 spinal arterial circle, 4 ventral spinal plexus, 5 poorly vascularized band.

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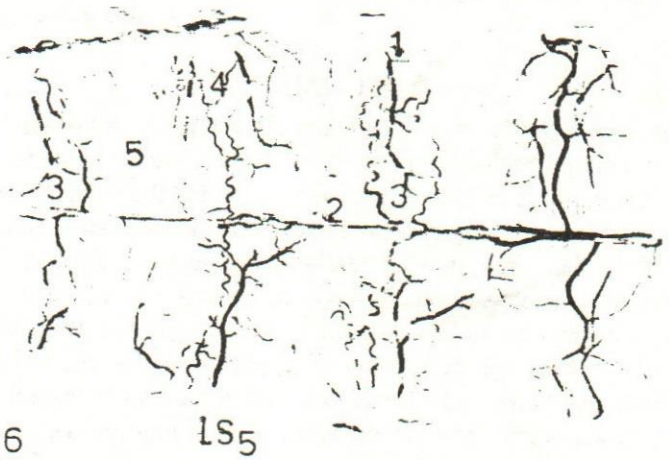
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