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دراسة على الحبل الشوكى لخفاش الفاكهة

محمد عبد المغنى ، رفعت شحاتة

اجريت هذه الدراسة على خمسة عشر خفاشا من خفافيش الفاكهة التى صيدت من المناطق القريبة من جامعة أسيوط .

ومن النتائج يتضح أن الحبل الشوكى للخفاش ينتهى عن الفقرة الصدرية الاخيرة وهذا يعنى ان هناك اختلاف فى نمو العمود الفقرى عن نمو الحبل الشوكى .

للحبل الشوكى تضخمان تضخم عنقى واخر قطنى عجزى ويحتوى التضخم العنقى على سبع قطع بينما التضخم القطنى العجزى يحتوى على أربعة قطع ويعزى هذا الاختلاف فى عدد القطع فى التضخمان الى الوظيفة ودرجة نمو الأطراف .

وقد وجد أن هذه الخلايا المكونة للمجموعة الوحشية من القرن الباطنى فى المنطقة العنقية أقصر من مثيلتها فى المنطقة القطنية العجزية .

ويعزى هذه النتيجة الى ان أجنحة الخفافيش كبيرة بينما الأطراف الخلفية صغيرة .

وجد أن عدد الخلايا المكونة للمجموعة المركزية للقرن الباطنى فى المنطقة العجزية أكثر من مثيلتها فى المنطقة العنقية وهذا يمكن ان يرجع الى أحتمال نمو العضلات المكونة لأرضية الحوض (حجاب الحوض) .

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A STUDY ON THE SPINAL CORD OF FRUIT BAT (MACROCHIROPTERA)

(With One Table & 8 Figs.)

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SUMMARY

A total number of 15 bats was used in this study. These were divided into two groups. In the first group (10 bats) complete laminectomy was done in five animals and mid-sagittal section in the remaining of the group was done to determine the extent of the cervical and lumbosacral enlargments and the level of termination of the cord. The spinal cord of bat terminates at the level of the last thoracic vertebra. It is measured 5.8 cm. in length. It has two enlargments cervical and lumbosacral. The cervical enlargment includes eight segments while the lumbosacral includes four segments. The spinal cord of the second group is sectioned and stained with gallocyanine to deal with ventral horn cell columns in order to correlate the number of cells in each column to the structure and function of the limbs. At the cervical level the mean number of the lateral group of the ventral horn cells is much more than those of the lumbar and sacral levels. The extent of enlargments and the mean number of the lateral group at different levels are due to the well developed wings and less developed hind limbs of bat. The central column is more marked at the sacral level than that at the cervical and lumbar levels. This is may be attributed to the well developed pelvic floor of bat.

INTRODUCTION

The human spinal cord begins at the cranial border of atlas vertebra (WARWICK and WILLIAMS, 1973). The vertebral level of termination of the spinal cord showed variation in most of the mammales. It terminates either at the lumbar or sacral regions (SAKLA, 1969; WARWICK and WILLIAMS, 1973; MANSOUR, 1980 and GABR et al. 1982). The length of the spinal cord fiffers among mammales (SAKLA, 1969; WAIBLE, 1973 and GABR, et al. 1982). The number of the spinal cord segments which sharesin the formation of the cervical or lumbosacral enlargment varies in most of mammales (WARWICK and WILLIAMS, 1973; DELLMAN and McCLURE, 1975; MANSOUR, 1980 and GABR et al. 1982).

CLARK, (1851); ROMANES (1951); ELLIOT, (1942); REXED, (1964) and WARWICK and WILLIAMS (1973) paied a great attention to the arrangment of cell groups and columns. They took into consideation the position of cell column relative to each other in the ventral grey horn of the spinal cord.

Bat shows a number of interesting features such as flying, having well developed wings and the less developed hind limbs and taking the upside down position during landing all these feature attract the author's attention to study the structure of its spinal cord.

MATERIAL and METHODS

A total number of 15 bats was used in this research. The bats were killed by ether inhalation. 10% formalin was used as a fixative. Five animals were immeresed in 10% trichloroacetic acid to decalcify the vertebral column. A midsagittal section was done in each column to determine the level of termination of the spinal cord in relation to the vertebral column.

The vertebral column of ten bats was cleaned from soft tissue, then complete laminectomy was done. The spinal cord was lift up from the vertebral canal and cut into cervical, thoracic, lumbar and sacral parts. These are dehydrated, cleared impregnated in a mixture of 1% celloidin and methyl benzoate) and embedded in paraffin. The blocks were sectioned transversly at 10U thickness and stained with Einarson's Gallocyanine (DRURY and WALLINGTON, 1980). The number of the cells of each column in the ventral grey horn is counted at different levels, in 10 sections for each level. The mean number of cells in each column is tabulated.

RESULTS

Gross Anatomy of The Spinal Cord of The Bat

The spinal cord of the adult bat extends from the cranial border of the atlas to the level of the last thoracic vertebra (Fig. 1,2 & 3).

The mean length of the spinal cord is 5.8 cm. The cord has 30 segments, 8 cervical, 13 thoracic, 5 lumbar and 4 sacral.

The meninges of the spinal cord are three, the duro, the arachnoid and pia maters in that order of arrangment from without inwards.

The spinal cord has two enlargments, a cervical enlargment and a lumbosacral one. The cervical enlargment extends from the third cervical segment through the second thoracic segment (Fig. 1). In relation to the vertebral column it extends from the 3rd cervical vertebra to the 2nd thoracic one. The lumbosacral enlargment extends from the third lumbar segment through the first sacral segment. It lies at the level of ninth thoracic vertebra to the thirteenth one (Fig. 1). The cord terminates in a bone like structure, the conus medullaris, from the apex of which the thin filum terminales, is surrounded by dural sheath, arises and terminates at the level of the second sacral vertebra (Fig. 2). The filum is 2.8 cm. in length. There is a pronounced cauda equina (Fig. 4).

The Nerve Cell Groups of The Ventral Grey Horn

The ventral horn cells are clustered in cell columns. They differ in arrangment at different regions of the spinal cord. some of these columns extend through the whole length of the cord while others are present at certain regions (Table 1).

At the cervical level (Fig. 5), the cell columns of the ventral horn are the lateral, medial and central groups. The lateral group is divided into ventrolateral, dorsolateral and retrodorsal columns. The medial group is divided into ventromedial and dorsomedial columns. The central group is centrally located and less extensive than those of the lateral and medial groups.

At the thoracic level (Fig. 6), the ventral horn contains only the medial group which is divided into ventromedial and dorsomedial columns.

At the lumbar level (Fig. 7), the cell groups of the ventral horn cells have the same distribution as in the cervical region. The cells of the lateral group are larger and distinct more than those of the medial group (Fig. 7).

At the sacral level (Fig. 8), the central column is highly represented than in other levels of the cord. But the lateral and medial groups are less marked.

The intermediolateral and intermediomedial are represented at all levels but the intermediolateral column is clearly marked at the thoracic and lumbar levels as shown in table 1 and Figures 6 & 7.

DISCUSSION

Extent of The Cord:

In the present study the spinal cord dose not fill the vertebralcanal as it terminates at the level of the last thoracic (T 13). This means that there is differential growth between the vertebral column and spinal cord. But in Microchiroptera, Chilonycteris, the spinal cord terminates about the level of the twelfth thoracic vertebra while in Artibeus Jamaicensis it terminates at the level of the eight or ninth thoracic vertebra (ARIENS KAPPERS et al. 1936).

The mean length of the bat spinal cord is 5.8 cm being longer than that of albino mice, 4.4 cm. (SAKLA, 1969) and shorter than that of albino rat, 12 cm. (WAIBLE, 1973). This is attributed to species difference.

The Spinal Cord Enlargments

The present study shows that the spinal cord has two enlargments, the cervical and lumbosacral like most other mammales (WARWICK and WILLIAMS, 1973, DELLMAN and McCLURE, 1975; MANSOURE, 1980 and GABR et al. 1982). The number of segments which are included in the cervical enlargment of bat is 7. It is the same in man (WARWICK and WILLIAM, 1973), but longer by one segment than that of dog (DELLMAN and McCLURE, 1975), donkey (MANSOUR, 1980). Irus monkey (THOMAS and COMBS, 1965) and buffalo (SHARMA and RAO, 1971).

Concerning the lumbosacral enlargment of bat the number of segments which are included is 4. It is the same in rabbit (GABR, et al. 1982) and dog, FLETCHER and kitchell, 1966. It is 8 in man (WARWICK and WILLIAMS 1973). This discrepancy in the number of segments of the cervical and lumbosacral enlargment may be referred to the differences in the function and the degree of development of the wings and the hind limbs of bat.

KENT (1969) stated that the enlargments results from large number of cell bodies and fibers innervating the appendages. The present study agrees with Kent as the number of the ventral horn cells at the cervical and lumbar enlargments are much more than those of the other levels table 1.

The Nerve Cell Groups of The Ventral Grey Horn

These were subdivided into cell columns depending on the aggreation of cells to form columns (WARWICK & WILLIAMS 1973, in man and GABR et al. 1982 in rabbit).

The medial group (ventromedial and dorsomedial columns) contains neurons that innervate, the neck, back, intercostal and a and abdominal musculature. The lateral group (ventrolateral, dorsolateral and retrodorsal columns) contains neurons that innervate the musculature of the limbs

(ELLIOTT, 1942). This was confirmed by the experimental work of ROMANES (1951) in cat. Referring to table 1, the mean number of cell bodies of the lateral group at the cervical level is much more than that of the lateral group at the lumbosacral level. This is attributed to the fact that the wings of bat are much more developed than the hind limbs.

The present work shows that the central column is represented at all levels except at the thoracic level. It is well developed at the sacral and cervical levels but the mean number of this column at the sacral level is larger than that of the cervical level. This is may be attributed to well developed pelvic floor of the bat.

The intermediolateral and the intermediomedial columns are represented at all levels. However the intermediolateral column is well developed at the thoracic and lumbar levels. These corresponds to thoracolumbar and sacral outflows in other mammals (WARWICK and WILLIAMS, 1973).

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Table (1): The mean number of the ventral horn cell columns at different regions of the spinal cord of the adult bat

Region	V.L.	D.L.	R.D.	V.M.	D.M.	C.	I.M.L.	I.M.M.
Cervical	4.8	3.2	1.7	4.5	5.5	3.1	3.2	3.3
Thoracic	-	-	-	5	4.2	-	5.4	3.9
Lumbar	2.9	3.3	2.4	3.5	5.8	1.4	5	4
Sacral	2.8	2	1.2	2.8	3.4	3.8	2.2	2

V.L. = Ventrolateral column
D.L. = Dorsolateral column
R.D. = Retrodorsalcolumn
V.M. = Ventromedial column
D.M. = Dorsomedial column
C. = Central column
I.M.L. = Intermediolaterel column
I.M.M.= Intermediomedial column

EXPLANATION OF FIGURES

Fig. (1): The spinal cord of adult bat showing:
1) Third cervical segment
2) 2nd thoracic segment
3) ninth thoracic vertebral
4) twelveth thoracic vertebral level of termination of the cord (arrow).

Fig. (2): The spinal cord of adult bat showing:
1) 2nd sacral vertebra (filum terminalis) level of termination of the cord (arrow).

Fig. (3): A mid sagittal section of the spinal cord adult bat showing:
1) Cones medullaris at the level of 13 thoracic verterba.
2) Filum terminalis.

Fig. (4): The spinal cord of adult bat showing the cauda equina.

Fig. (5): Section of the spinal cord of adult bat at the cervical level showing the ventral grey horn cell columns.
1) Ventrolateral
2) Dorsolateral
3) Retrodorsal
4) Ventromedial
5) Dorsomedial
6) Central
7) Intermediolateral and Einarson's Gallocyanine X 50
8) Intermediomedial

Fig. (6): Section of the spinal cord of adult bat at the thoracic level showing the ventral grey horn cell columns:
1) Ventromediel
2) Ventrodorsal
3) Intermedio lateral
4) Intermediomediel Einarson's Gallocyanine X 50

Fig. (7): Section of the spinal cord of adult bat at the lumbar level showing the ventral grey horn cell columns.
1) Ventrolateral
2) Dorsoleteral
3) Retrodorsal
4) Ventromediel
5) dorsomedial
6) Central
7) Intermediotateral
8) Intermediomedial Einarson's GallocyanineX50

Fig. (8): Section of the spinal cord of adult bat at the sacral level showing the ventral greyhone cell columns.

1) Ventrolateral
2) Dorsolateral
3) Ventromedial
4) Dorsomedial
5) Central
6) Intermediolateral Einarson's · Gallocyanine X 50.

SUMMARY & CONCLUSION

The spinal cord of bat terminates at the level of the last thoracic vertebra. This means that there is a differential growth between th vertebral column and the spinal cord.

It has two enlargments, cervical enlargment which includes 7 segments and lumbosacral one which includes 4 segments. The extent of the cervical and lumbosacral enlargments depend upon the function and degree of development of the limbs.

The mean number of lateral group of the ventral horn cells at the cervical level is much more than that of the lumbosacral level as the wings of bat are much more developed than the hind limbs.

The central column is well developed at the sacral and cervical levels but the mean number at the sacral level is much more than that of the cervical level. This is may be attributed to the well developed pelvic floor.

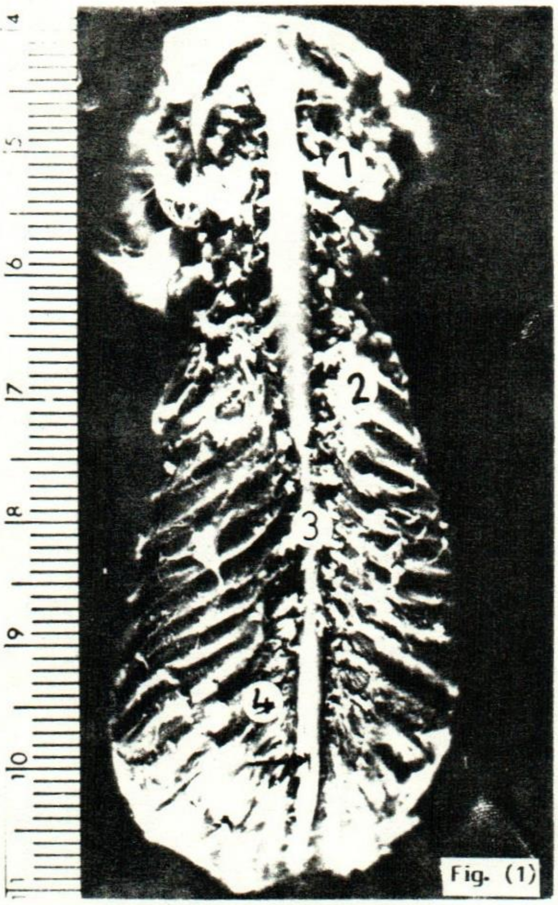

Fig. (1)

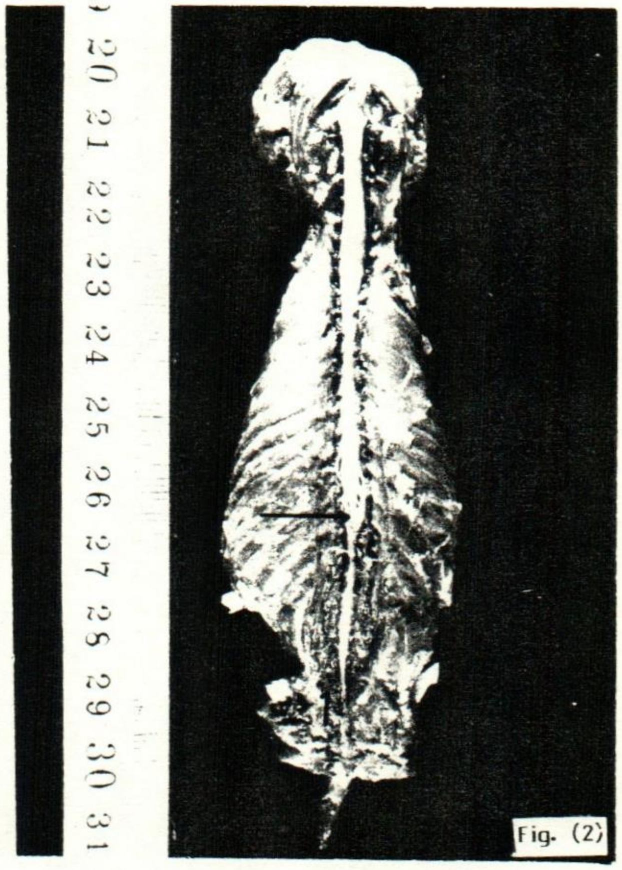
Fig. (2)

Fig. (3)


Fig. (4)

Fig. (5)

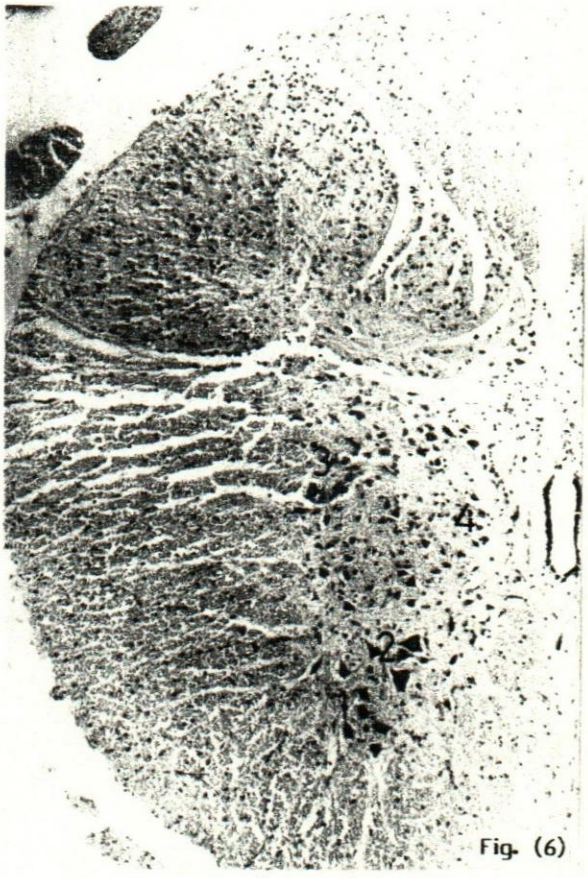

Fig. (6)

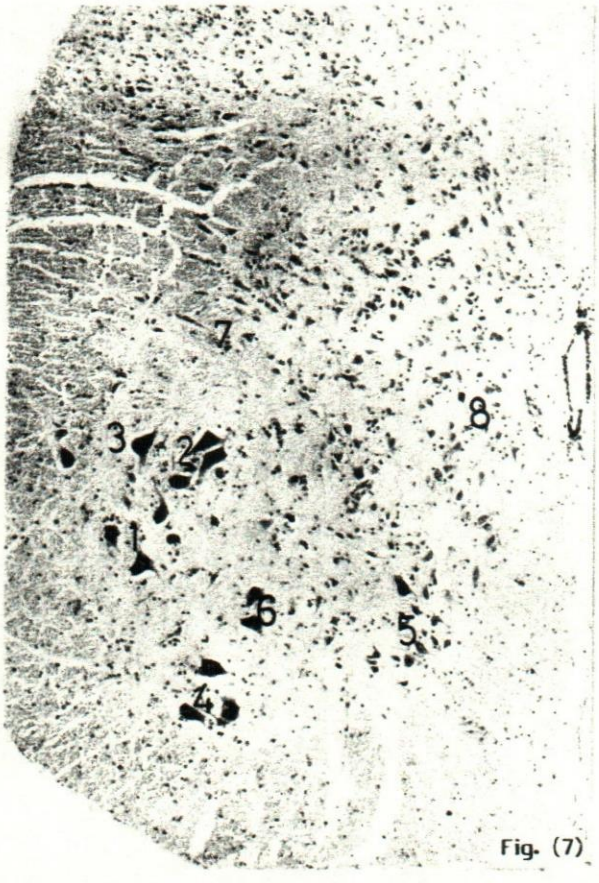

Fig. (7)

Fig. (8)