The Macroanatomical study on the Phrenic Nerve in New Zealand Rabbit.

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Summary: In this study, formation of the phrenic nerve and its general run was investigated. Fifteen New Zealand Rabbit of either sex, on an average 3000 gr .body weight,were used. Pratically, phrenic nerve is formed from the ventral branch of the fifth cervical nerve and sometames from the contribution of a weak branch of the sixth cervical nerve in rabbits. No differences were found between the run of right and left phrenic nerve located in anterior and posterior mediastinum. There is no connection between the nerve fibers of each side. Symphatic fibers were found to arise from the ggl. cervicothoracicum(ggl. stellatum), except two materials in which symphatic fibers were arised from the medial cervical ganglion.

Key Words: Rabbit, Phrenic nerve, Nerve

Recherche Macroanatomique sur le nerf phrenique dans les Lapins de New Zealand.

Resume: Dans cette recherche, on a examine la formation de nerf phrenique et sa situation generale dans les lapins. On a profite de 15 lapins pour ce realiser. Le nerf phrenique dans les lapins s'est compose de la branche ventrale du cinquieme nerf de cou. Parfois le sixieme y est. Mais ce dernier est tre s faible. Phreme nerf qui se trouve dans la gauche et droite traverse axillar artery et axillar vein au moment qu'il entre au sein. On a constate qu'il n'y a pas d'une grande difference entre mediastinum cranale et caudale de nerf phrenique droit et gauche. Meme, il n'y a aucune correspondance entre les fils des nerfs a des deux côtes. Les deux pieces exceptees, les fils sympathiques de tous materiels sont lies au ggl.Cervicothoracicum (ggl. Stellatum). Quant a ces deux pièces, leurs fils sympathiques sont lies au ggl. Cervicale medium.

Les mot-clés: Nerf phrenique, Lapin, Nerf

Yeni Zelanda Tavşanlarında (Orytologus Cuniculus L.) N. Phrenicus Üzerine Makroanatomik Bir Çalışma

Özet: Bu araştırmada Yeni Zellanda tavşanlarında n. phrenicus un teşkili ve genel seyri incelendi. Bu amaçla ortalama ağırlığı 3000 gr olan 15 adet tavşan materyali kullanıldı. Tavşanda n. phrenicus beşinci boyun sinirinin ventral dalından oluşur. Bazen altıncı boyun sinirı de katılır. Fakat bu katkı oldukça zayıftır. Sağ ve sol n. phrenicus un mediastinum cranale ve caudale'deki seyri arasında büyük bir farkın olmadığı saptanmıştır. Her iki taraftaki sinir ipliklerı arasında her hangi bir bağlantı da yoktur. İki piyes hariç tüm materyaller sempatik ipliklerini ggl. cervicothoracicum (ggl. stellatum)'dan alır. Bu iki piyesde ise sempatik ipliklerin ggl. cervicale medium'dan aldığı saptandı.

Anahtar kelimeler: Tavşan, Nervus phrenicus, Sinir

Introduction

It is known that rabbit plays a dynamic role in meat and leather industry. Rabbit is also frequently used as a laboratory animal. However its anatomy has been studied by different autors(1,22,25), in but detailed study has been reported on phrenic nerve of New Zealand Rabbit, recently.

In rats phrenic nerve is formed from the ventral branch of fifth cervical nerve or connection of the fourth and fifth ventral branches of cervical nerves (12). In rabbits, it is formed from the ventral branches fourth (6,19), fifth cervical nerve (5) or fourth, fifth and sixth cervical nerves (1). In cats, it is formed from the fifth and sixth cervical nerves (11,27). However, according to the (17) and (24), phreme nerve is formed from the ventral branches sixth and seventh cervical nerves in cats. In domestic animals, phrenic nerve is usually formed from the connection of the ventral branches of the fifth, sixth and seventh cervical nerves (5,14). Sometimes, the ventral branch of the fourth cervical nerve also helps the formation of the phrenic nerve (11). In sheep, only the ventral branch of fifth nerve (26) or connection of the ventral branches of fifth, sixth and seventh cervical nerves form the phrenic nerve (21). In sheep, the contribution of the ventral branch of the fifth cervical nerve on the formation of phrenic nerve is not well-known because it is not mostly present (11,16). Dursun(8) has reported that is contribution to the formation of phreme nerve

is very poor . Phrenic nerves on each side join together on the scalene muscles and run as a single nerve fibre caudally (8,16). It receives its symphatic fibers from ggl. stellatum (6,8,15,18,26), truncus symphaticus (20), or fyrst thoracal ganglion (16), ggl. cervicale medium (12), or nn.intercostales (9). However, there is as contrary report to Miller's(20),that expresses the absence of fibers from truncus symphaticus (10). It has been reported that there is a connection between left and right phrenic nerves in rabbit (2). Their running shows differences and right phrenic nerve runs caudally on the dorsal wall of cranial vena cava, it ends on the caudal vena cava due to plica vena cava caudalis (6,7,9). Left phrenic nerve runs caudally on the medial of subclavial artery and on the dorsal of subclavial vein. In the pleura mediastinalis, yt runs caudally over pericardium by crossing the arcus aortae, and innervates the corresponding part of the diaphragm (3,6). Phrenic nerve spreads first to the centrum tendineum, then to the diaphragm muscles. Each phrenic nerve innervates its own diaphragm part (Barone, 1986). During its run it gives rr pericardii for pericardium (8,9,11,15).

Material and Methods

Fifteen adults New Zealand Rabbits, mean weight 3000 gr, obtaineed from the Etlik Animal Disease Research Institute, Ankara, were used. After deep anesthesia the animals were killed. To follow neighborhood of the phrenic nerve to the veins and arteries in thorax veins were filled with blue latex, from caudal vena cava; and arteries were filled with red latex, from abdominal aortae.The ribs on the both sides were removed by the costotome. Then entire material was stored at 4 °C for a day and was disssected under a disssection microscope. NAV terms(13) were used in this investigation.

Results

In the New Zealand Rabbits, phrenic nerve consist of the ventral branch of the fifth cervical nerve (figure 1,2/C_5). In six of materials, phrenic nerve also received a slender branch form sixth cervical nerve. It was found that fibers coming from the sixth cervical nerve arise along with suprascapular and supraspinata nerves which are branches of the brachial plexus. Phrenic nerve makes connnection between these branches by a small fiber (Figure 1,2/C_6). In one material, yt was also found that the phrenic nerve receives a thin branch from the seventh cervical nerve.

Phrenic nerve originates along with fifth cervical nerve (scapulodorssal nerve). It runs backward in the medially to the brachial plexus, dorsally to the external jugular vein, ventrally to the dorsal scalen muscle and laterally to the right and left cranial vena cava. Then each nerve enters cranial thoracic aperture and innervates the diaphragm.

During its run, phrenic nerve does not make any connection between both sides. Symphatic trunc which lie in the latreral side of phrenic neerve. In the thorax, phrenic nerve on the both sides receive its symphatic fibers from the ggl. stellatum. However contribution of symphatic fibers from the ggl.cervicale medium was also obnserved in two materials(15 %).

The phrenic nerve, at the left side passes between the axillary and superficial cervical arteries in the anterior mediastinum. Then, it runs caudally in the medial side of axillary and internal thoracic arteries. Thus it stays between the axillary vein and axillary artery. It is followed toward to the basis cordis , inside the plica vena cava, at this point it is in the lateral side of left cranial vena cava. During its run, it receives symphatic fibers from the ggl. stellatum at the level of bifurcation of the bijugular trunk, and gives off rr. pericardii to the pericardium on the auricula sinister. Then it enters mediastinum posterior by runnig caudally to the ventral side of bronchus principles sinister and laterally to the left cranial vena cava. It ends there by giving 4 or 5 branches.

Distribution of the phrenic nerve at the right side is similar to that of lift side. It runs caudally after entering the thorax . It passes caudally between the axillary and superficial cervical arteries. At that place, yt is present laterally to the axillary artery, medially to the axillary vein, ventral to the internal thoracic artery. (figure:2/1) At this point it also stays in the lateral side of right azygos vein and common trunk of the vertebral vein, costocervical vein and cervicoprofund vein.The phrenic nerve runs toward to the right auricula over the right cranial vena cava, then yt arrives centrum tendineum of diaphragm. It ends by giving off 3 branches in the tendomusculer border of the diaphragm.

Discussion

Phrenic nerve consists of ventral branches of fifth cervical nerve or joining of ventral branches of fourth and fifth cervical nerves in rats (Greene 1969), ventral branches of fourth cervical nerves (Craige 1969;Mc Laughn et al 1979) or fifth cervical nerve in rabbits.(Çalýþlar 1978). According to Aslan (1964) in rabit and cats, it can origin from the ventral branches

of fourth, fifth and sixth.cervical nerves. In this study yt was found that pherenic nerve formes from the ventral branch of the fifth cervical nerve. It was also found that fibers of the nerve coming from tthe ventral branch of sixth cervical nerve are small and poor in six materals. This result is consistent with the result of Getty1.975 and Wingerd, 1984.

Some authors (Barone et al 1973;Craige 1969) reported that, phernic nerve, at the left side, is located in the doral side of subclavial vein and in the medial side of subclavial artery when it enters to the thorax. Whereas the present data demonstrate that phrenic nerve passses caudally between the axillary and superficial cervical arteries. At this point, the phrenic nerve stays between the axillary artery and axillary vein

However, phrenic nerve at the right side runs caudally to the dorsolateral wall of the cranial vena cava and it ends on the diaphragm in company with caudal vena cava (Craie1969; Crouch et al 1969; Dyce et al. 1978)

It was found that, phrenic nerve receives their symphatic fibers from the ggl. stellatum in 13 materials (85%). This result is consistent with the previous studies (Craige 1969; Dursun 1981; Koch 1963, McKybben et al 1968;Tecirlioðlu 1983) It was also found that phrenic nerves receives its symphatic fibers from the ggl.cervico-medium in 2 materials (15%). These findings confirm the results of Green's (1963). Although it has been suggested that there is a connection between right and left phrenic nerves (Barone 1986) we did not observe this connection.

References

1.Aslan,K (1994): Yerli kedi (Felis Domestica L.) ver Beyaz Yem Zelanda Tavşaanının(Orytolagus cuniculus L.) Plexus Barachialis'i Üzerinde Karşılaştırmalı Macroanatomik Bir Çalışma. I.U. Vet. Fak. Derg. 20(2-3).197-208.

2.Barone, R. (1986): Anatomie Comparee des Mammiferes Arthrologie et Myologie Domestiques. Tome II. Vigot Freres. Ed. rue de l'Ecole de Medicine 75006 Paris.

3.Barone,R., Pavaux,C., Blin,P,C., Cuq,P. (1973): Atlas D'Anatomie du Lapin. Atlas of Rabbit Anatomy. Masson et C. Paris.

4.Çalışlar, T. (1978): Laboratuvar Hayvanları Anatomisi. I.U. Vet. Fak. Yay. 14. A.Ü. Basımevi, Ankara.

5.Çalışlar, T. (1989): Evcil Hayvanların Anatomisi. I. Köpek, Sığır, Koyun ve Keçi Diseksiyonu. I.U. Vet. Fak. Yay. No:3569 Istanbul.

6.Craige, E.H. (1969): Pratical Anatomy of the Rabbit. Fronto University of Toronto Press.

7.Crouch, J.E., Lackey, M.B. (1969): Text-Atlas of Cat Anatomy. Lea Febriger. Philadelphia.

8.Dursun, N. (1981) Merkebin N. phernneus'u üzerinde anatomik araştırmalar. A.Ü. Vet. Fak. Derg. 27, 3-4.

9.Dyce, K.M., Sack, W.O., Wensing, C.J.E. (1987): Textbook of Vetermary Anatomy. W.B. Saunders Company. Philadelphia-London-Toronto-Tokyo.

10. Field, H.E., and Taylor M.E. (1969): An Atlas of Cat Anatomy. The University of Chicago Press.

11. Getty, R. (1975): Sisson and Grossman's Anatomy of the Domestic Animals. Vol. I. W.B. Saunders Company. Philadelphia-London. Toronto:668.

12. Greene, E.C. (1963): Anatomy of the Rat. Hafner Publishing Company. New York and London.

13. International Anatomical Nomenculature Comittee. (1983) "Nomina Anatomica Veterinaria" Third Edition Ithaca , New York.

14. Jenkins,T.W.(1972): Functional Mammalian Neuroanatomy. Lea- Febriger,Philadelphia.

15. Koch, T., Berg, R. (1993): der Veterinar Anatomie Band III. Die Grober Versorgung und Steuerung Susteme. Gustav Fischer Verlag Jena. Stuttgart 366.

16. May ,N.D.S.(1964): The Anatomy of the sheep. Second Ed. University of Queesland Press. St. Lucia. Barisbane,Queesland.

17. Mc. Clure, R.C., Dallman, M.J., Garrett, P.D. (1973): Cat Anatomy an Atlas, Text and Dissection Qunde. Lea-Febriger. Philadelphia.

18. Mc. Kibben, J.S., Getty, R. (1968): Acomparative Morphologic Study of the Cardiac Innervation in Domestic Animals I. the Canine. Am. J. Anat. 122, 533-544.

19. Mc Laughlin, A.C., Chiasson,B.R (1979): Labatotory Anatomy of the Rabbit. Second Ed. Wm.C.Brown Company Publishers Dubuque Iowa.

20. Miller, M.E., Christensen, G.C., Evans, H.E. (1964): Anatomy of the Dog. Philadelphia. W.B. Saunders Company.

21. Nickel, R., Schummer, A., Seiferle, E. (1975): Lehrbuch der Anatomie der Haustiere. Bd. I., 2. Augl. Paul Parey, Berlin-Hamburg.

22. Nur, H.(1995): Yeni Zelanda Tavşanlarında V. Porta'nın Oluşumuna Katılan Dallar Üzerinde Makroanatomik Bir Çalışma.(Baskıda). Y.Y.Ü. Vet. Fak. Derg. 6, 1-2.

23. Öcal, M.K. (1985): Kedi (Felis Domestica L.) ve Tavşanın (Arycotolagus Cuniculus L.) Larynx'ı Üzerinde Karşılaştırmalı Makroanatomik ve Subgros Araştırmalar.

24. Pierrard, J. (1972): Anatomie Appligee Des Carnivores Domestiques Chien et Chat. Malome S.A. Edteur, 27 rue del'Ecole-de-Medecine. Paris.

25. Tecirlioğlu, S. (1969): Kedi ve Tavşanların Kasları Arasındaki Sabit Anatomik Avrımlar. Doktora Tezi. A.Ü. Vet. Fak. Yay. 243. A.Ü. Vet. ve Zirnat Fak. Basımevi. Ankara.

26. Tecirlioğlu, S. (1983): Komparativ Veterıner Anatomi. Sinir Sistemi. A.Ü. Vet. Fak. Yay. 389. A.Ü. Basımevi- Ankara.

27. Wingerd, B.D.(1984): Rabbit Dissection Manual. The Jhons Hopkins University Pree. Baltimore- London.

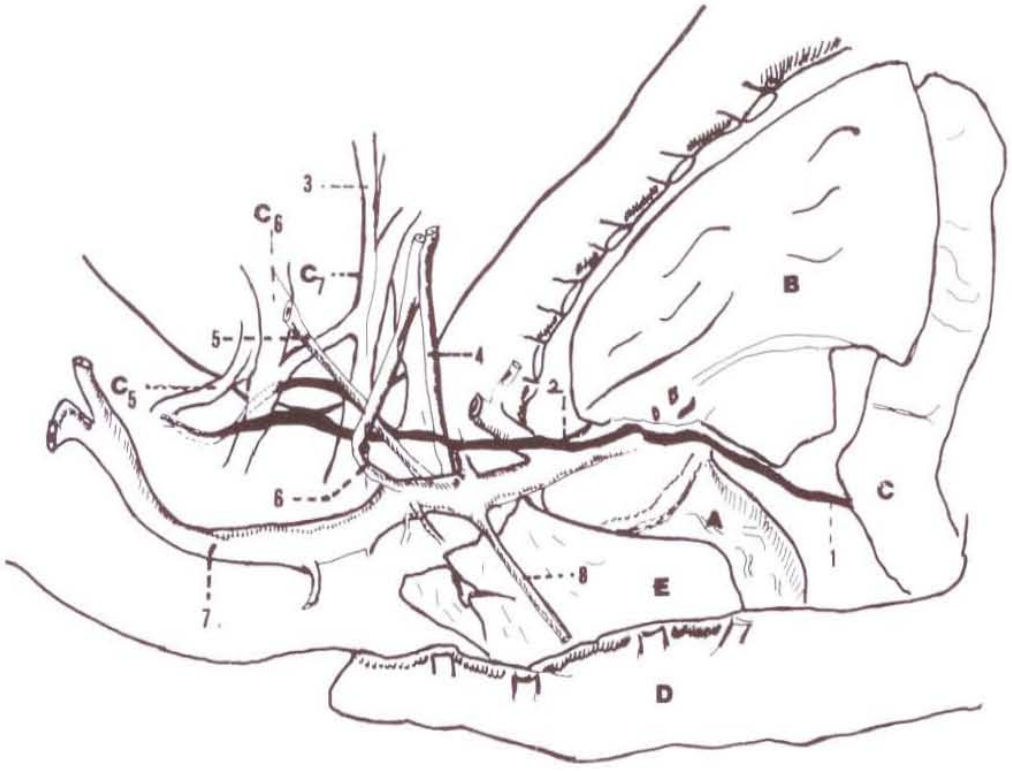

Figure 1 Vessels and Nerves on Thoracic Wall of Rabbit (Sinister view)

C_5- Fifth cervical nerve

C_6-Sixth cervical nerve

C_7- Seventh cervical nerve

1- Phrenic nerve; 2- sinister cranial cava vein; 3- brachial plexus; 4-axillary artery; 5- cervical superficial artery; 6- axillary vein; 7- external jugular vein; 8- thoracic internal vein; A- Cor; B-Pulmo; C- Diaphragma; D-Sternum; E-Thymus

Figure:2. Vessels and Nerves on Thoracic Wall of Rabbit (Dexter view)

C_5- Fifth cervical nerve
C_6-Sixth cervical nerve
C_7- Seventh cervical nerve
C_8-Eight cervical nerve

1- Phrenic nerve, 2- dexter cranial cava vein, 3- brachial plexus; 4-axillary artery, 5- cervical superficial artery 6- axillary vein, 7- external jugular vein, 8- thoracic internal vein: A- Cor, B-Pulmo, C- Diaphragma, D- Sternum, E-Thymus