

Comparative Anatomy of the Korean Native Goat

3. Muscles of the Thoracic Wall

Yong Keun Kim, D.V.M., M.S.

Department of Veterinary Medicine, Gyeongsang National College

Chang Key Kim, D.V.M., M.S.

Department of Animal Science, Chungbuk National College

Suk Bong Yoon, D.V.M., M.S., Ph.D.

Department of Veterinary Medicine, College of Agriculture, Seoul National University.

Introduction

A detailed knowledge of the anatomy of the goat is necessary for the understanding of many problems in the fields of physiology, pathology and surgery, including those related to many experimental works on this animal. There were, however, few reports on the anatomy of the goat with special reference to its musculature. In the text books of veterinary anatomy available at present, the goat has been left out of consideration or simply compared with cattle and sheep without detailed description. But direct carry-over of the information from cattle or sheep to the goat might be impossible for the studies requiring specific anatomical knowledge.

In recent years, the Korean native goat has been used frequently as a subject for many experimental studies, but its anatomy has not yet been completely elucidated. As a basis for clinical and the other experimental works, it was keenly felt necessary to describe in detail the anatomy and to compare with that of the other animals.

Our endeavour in the present paper was limited to describe and to illustrate the gross anatomy of the muscles of the thoracic wall of the Korean native goat.

The nomenclature employed in this paper was

chosen, taking into consideration that used by the other authors.

Materials and Methods

Eleven Korean native goats of both sex (5 males and 6 females), with black hair and ranging in body weight from 15 to 25kg were grossly dissected. After sacrifice, they were infused with and stored in embalming fluid (50% isopropyl alcohol, 10% glycerine, 5% formalin, 5% phenol, 30% water). All illustrations were made while directly viewing the dissected specimens.

Results and Discussion

M. serratus dorsalis cranialis

Origin: The fascia spinotransversalis by a broad and thin aponeurosis.

Insertion: The fourth to seventh ribs by four digitations.

This muscle is a flat muscle lying under *M. rhomboideus* and *M. serratus ventralis*, and partially covering *M. longissimus* and *M. iliocostalis*. In the Korean native goat this muscle was very poorly developed, observed in only one goat. In the sheep, May⁸⁾ described that it comprises only two digitations and, in the ox, Sisson⁹⁾ that it has four digitations when fully developed, but it may be absent. Therefore, it is considered that in the Ko-

rean native goat the development of this muscle resembled with those of the sheep and ox, though it differed from other animals in its development.

M. serratus dorsalis caudalis

Origin: The lumbo-dorsal fascia of the lumbar region by a broad aponeurosis.

Insertion: The caudal border of the last four ribs or the five ribs.

This muscle consisted of 4 or 5 digitations and its fibers ran cranioventrally from the origin. The portion of the insertion was partially covered by *M. intercostales externi* and the fibers of the last digitation terminated partially in the medial surface of *M. obliquus externus abdominalis*.

M. scalenus

This muscle was composed of a superficial portion (*M. scalenus supracostalis*) and a deep portion (*M. scalenus primae costae*), each of them was clearly separated into the dorsal and ventral parts.

M. scalenus supracostalis

Origin: Ventral part arose on the third and fourth ribs. Dorsal part arose on the first ribs.

Insertion: Ventral part was attached the transverse of the fourth, fifth and sixth cervical vertebrae.

M. scalenus primae costae

Origin: The first rib.

Insertion: Ventral part was attached to the transverse processes of the third, fourth, fifth and sixth cervical vertebrae. Dorsal part was attached to the transverse process of the last cervical vertebra.

M. scalenus primae costae was covered by *M. scalenus supracostalis* and divided into the dorsal and ventral parts, between which the brachial plexus emerged. *M. scalenus supracostalis* was thinner than the former and not distinctly separated into the ventral and dorsal parts in their insertions: the dorsal part passed on the 2 or 3 digitations of *M. serratus ventralis* to terminate on the second and third ribs. According to May,⁵⁾ in the sheep, this muscle was separated into 2 parts, the ventral and dorsal parts, taking their origins from the first rib only. Observing his drawings on this muscle, we were able to find that the sheep differs

from the goat. By May's drawings it is likely that the sheep has only the deep portion of the goat. According to Sisson⁹⁾ the ox has 2 portions, one of which origins from the first rib and the another from the fourth rib, as in our study on the Korean native goat.

M. transversus costarum

Origin: Running caudoventrally to be inserted on the adjacent parts of the sternum by a broad and flat tendon.

This muscle was a flat and retangular muscle lying below *M. scalenus supracostalis* and covered by the pectoral muscle.

Mm. levatores costarum

Origin: The transverse processes of the thoracic vertebrae.

Insertion: The cranial border of the rib succeeding vertebra from which the muscle arose.

These muscles were composed of twelve pairs covered by *Mm. longissimus dorsi* and *iliocostalis*. They were not clearly separated from *Mm. intercostales externi*, overlying the dorsal ends of the intercostal spaces.

Mm. intercostales externi

Origin: The caudal borders of the ribs.

Insertion: The cranial borders of the succeeding ribs.

These muscles occupied the intercostal spaces from *Mm. levatores costarum*, which were indistinctly set apart, to the costochondral junctions. In the last three intercostal spaces, occasional defects in the muscles were found at the portions of the insertion of *M. serratus dorsalis caudalis* and of the origins of *M. obliquus externus abdominalis*.

Mm. intercostales interni

Origin: The cranial borders of the ribs.

Insertion: The caudal borders of the proceeding ribs.

The fibers passed obliquely downward in the opposite direction to those of the *externi*. In the cranial six intercostal spaces they were only slightly separated from *Mm. intercartilaginei*, though the fibers of the former were directed ventrally than thoses of the latter: in the caudal five intercostal

spaces were clearly separated because of the directions of their fibers differed from each other.

Mm. intercartilaginei

These muscles occupied the interchondral spaces with the exception of the seventh interchondral space. Because the seventh and eighth costal cartilages were closely contacted with each other, in the seventh interchondral spaces the muscle was completely absent. The fibers ran almost longitudinally in the cranial six interchondral spaces and almost vertically in the caudal five interchondral spaces (these are asternal interchondral spaces in the goat): the former may be considered, therefore, to be continued to Mm. intercostales interni and the latter Mm. intercostales externi. These muscles were completely covered by the fatty tissue in the cranial spaces and by M. obliquus externus abdominalis in the caudal spaces.

Most authors don't separate Mm. intercartilaginei from Mm. intercostales in the description of muscles of the animals. However, in the Korean native goat, it seems quite plausible that they are separated from each other in the description. According to Miller,⁶⁾ in the dog, these muscles are composed of the externi and interni being unseparated continuations of the respective external intercostales and internal intercostales: Ellenberger²⁾, in the horse, described that these muscles are a layer of muscles taking almost horizontal direction. But in the Korean native goat they were not divided into the externi and interni and clearly separated from Mm. intercostales in the caudal five interchondral spaces, though slightly separated in the cranial 6 interchondral spaces.

M. retractor costae

Origin: The transverse process of the first lumbar vertebra.

Insertion: The caudal border of the dorsal end of the last rib dorsal to the insertion of M. obliquus internus abdominalis.

It was a flat muscle lying under M. serratus dorsalis caudalis.

May,⁵⁾ in the sheep, regards the last digitation of M. serratus dorsalis caudalis as M. retractor

costae, describing that the latter muscle arises from the lumbo-dorsal fascia and is inserted to the proximal end of the last rib and the former muscle is inserted to the ninth to the twelfth ribs. But in the present study we are able to observe an independent muscle to be clearly separable from the last digitation of M. serratus dorsalis caudalis which is inserted to the last rib.

M. transversus thoracis

Origin: The sternal ligament, contacting with the opposite muscle.

Insertion: The costal cartilages of the second to the seventh ribs.

This muscle was a flat muscle placed on the inner surface of the sternum and the cartilages of the sternal ribs. This muscle terminated with segmentations on the costal cartilages.

Diaphragma

This was a musculotendinous plate which formed a partition between the thoracic and abdominal cavities: it projected forward into the thoracic cavity of a fleshy rim and a tendinous center.

Attachment: (1) Pars sternalis- the inner surface of the xiphoid cartilage. (2) Pars costalis- the distal part of the last three ribs and the corresponding cartilages: the seventh to the tenth costochondral junctions and cartilages. (3) Pars lumbaris-(a) Crus dextrum arose from the ventral longitudinal ligament by a strong tendon: (b) Crus sinistrum arose from the first two lumbar vertebrae.

From the above origins the fibers converged to form an insertion into the central tendon.

Conclusion

The muscles of the thoracic wall of the Korean native goats were described, illustrated and compared with those of other animals.

1. M. serratus dorsalis cranialis was poorly developed, observed in only one goat.

2. M. scalenus was divided into two portions, M. scalenus supracostalis and M. scalenus primae costae, each of them was clearly separated into the dorsal and ventral parts. M. scalenus supracostalis arose from the third and fourth ribs.

3. *Mm. intercartilaginei*, occupying the interchondral spaces, was completely absent in the seventh interchondral spaces. The fibers ran almost longitudinally in the cranial 6 interchondral spaces and

almost vertically in the caudal 5 interchondral spaces, the former may be considered, therefore, to be continued to *Mm. intercostales interni* and the latter *Mm. intercostales externi*.

Explanations for Plates

Fig. 1. Lateral view of muscles of neck and thorax.

Fig. 2. Lateral view of deep muscles of thoracic wall. In the 4th and 5th intercostal spaces *M. intercostales externi* were removed.

Fig. 3. Abdominal surface of Diaphragma.

Fig. 4. Ventral view of thoracic wall, showing the arrangement of *M. transversus thoracis*.

Fig. 5. *M. scalenus supracostalis* and *M. scalenus primae costae*.

Fig. 6. *M. retractor costae*.

Abbreviations

34: *M. serratus dorsalis cranialis*, 35: *M. serratus dorsalis caudalis*, 36A: *M. scalenus supracostalis*, 36B: *M. scalenus primae costae*, 37: *M. transversus costarum*, 38: *M. levatores costarum*, 39: *Mm. intracostales externi*, 40: *Mm. intercostales interni*, 41: *Mm. intercartilaginei*, 42: *M. retractor costae*, 43: *M. transversus thoracis*, 44: Diaphragma, A: *Vena cava caudalis* B: *Esophagus*, C: *Aorta*, D: *Crus dextrum*, E: *Crus sinistrum*.

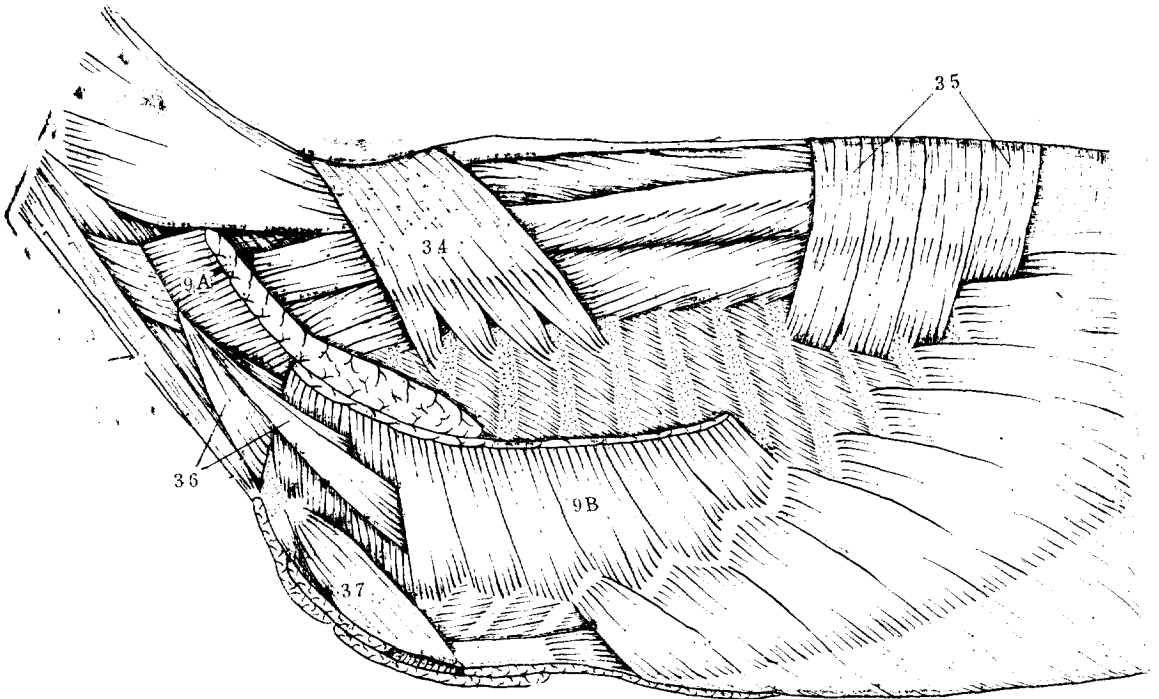


Fig. 1.

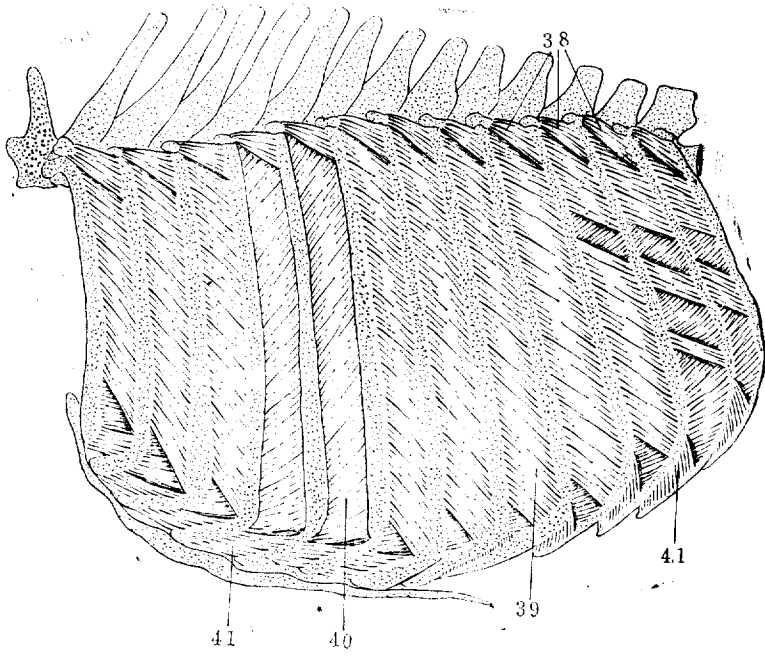


Fig. 2.

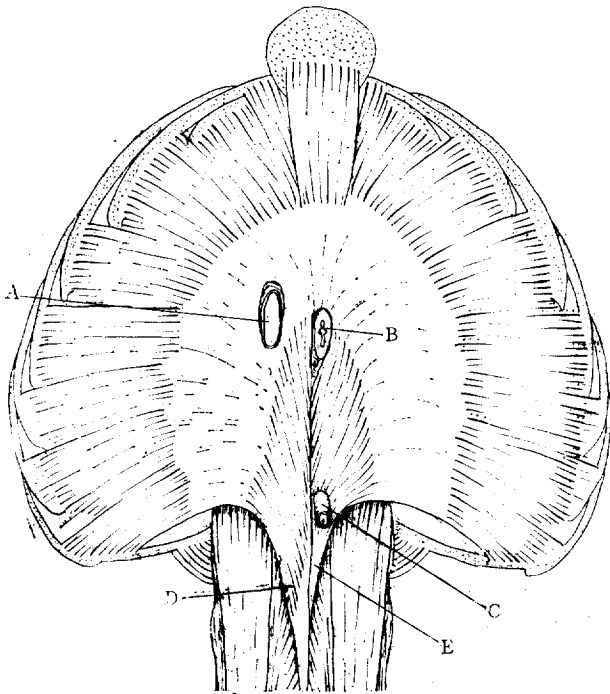


Fig. 3.

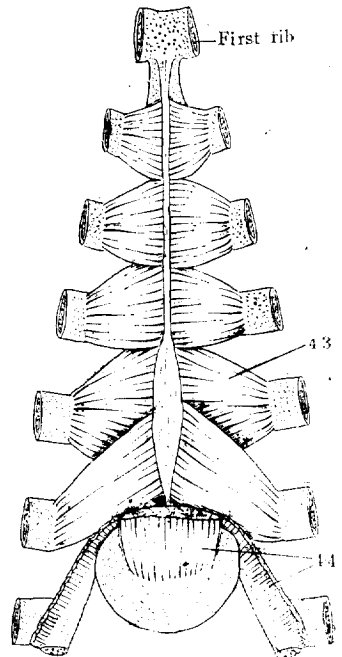


Fig. 4.

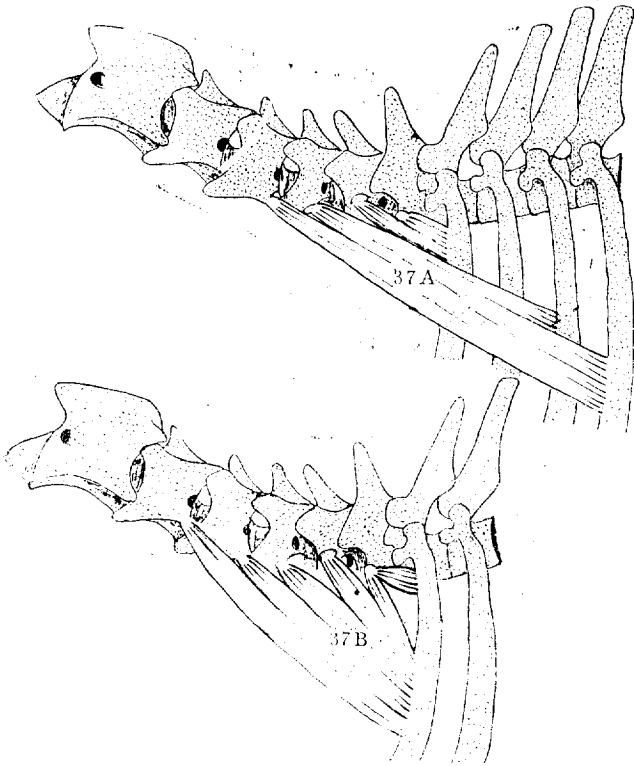


Fig. 5.

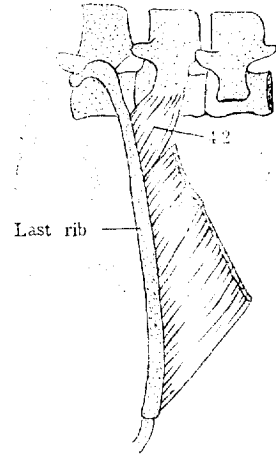


Fig. 6.

References

1. Craigie, E.H.: Practical anatomy of the rabbit. 8 ed. Blakiston, Philadelphia (1948).
2. Ellenberger, W. und Baum, H.: Handbuch der vergleichenden Anatomie der Haustiere. 13 Aufl., Springer Verlag, Berlin (1943).
3. Foust, H.C. and Getty, R.: Atlas and dissection guide for the study of the anatomy of the domestic animals. 3 ed. Iowa State College Press, Ames, Iowa (1954).
4. Gray, H. and Gross, C.M.: Anatomy of the human body. 27 ed. Lea & Febiger, Philadelphia (1962).
5. May, N.D.S.: The anatomy of the sheep, 2 ed. University of Queensland Press, St. Lucia, Queensland (1970).
6. Miller, M.E., Christensen, G. C. and Evans, H.E.: Anatomy of the dog. Saunders Co., Philadelphia and London (1965).
7. Miller, R.A.: The musculature of panpaniscus. Am. J. Anat. (1952) 91 : 183.
8. Reichard, J., Jennings, L.B. and Elliott, R.: Anatomy of the cat. 3 ed. Henry Holt and Co., New York (1935).
9. Sisson, S. and Grossman, J.D.: The anatomy of the domestic animals. 4 ed. Saunders, Philadelphia and London (1943).
10. Yoon, S.B.: The comparative anatomy of the domestic animals. Moon Un Dang. Seoul(1971).
11. Yoon, S.B., Mun, H.C., and Kim, C.K.: Comparative anatomy of the Korean native goat. I. Muscles of the thoracic limb. Korean J. Vet. Res. (1974) 14 : 135.

韓國在來山羊의 比較解剖學的研究

3. 胸壁筋에 關하여

金 容 根

金 昌 基

尹 錫 鳳

慶尙大學 獸醫學科

忠北大學 畜產學科

서울大學校 農科大學 獸醫學科

국문초록

韓國在來山羊 11頭의 胸壁筋을 절개하여 관찰하였던 바 다음과 같은 結果를 얻었다.

1. 山羊의 胸壁에는 횡격막을 포함하여 11개의 筋들을 확인할 수 있었다: 前背鋸筋 *M. serratus dorsalis cranialis*, 後背鋸筋 *M. serratus dorsalis caudalis*, 斜角筋 *M. scalenus*, 肋橫筋 *M. transversus costarum*, 肋骨擧筋 *Mm. levatores costarum*, 外肋間筋 *Mm. intercostales externi*, 內肋間筋 *Mm. intercostales interni*, 肋軟骨間筋 *Mm. intercartilaginei*, 肋骨後引筋 *M. retractor costae*, 胸橫筋 *M. transversus thoracis*, 橫隔膜 *Diaphragma*.

2. 前背鋸筋의 발달이 아주 미약하여 단지 1例에서만 볼 수 있었다.

3. 斜角筋은 淺部(*M. scalenus supracoastalis*)와 深部(*M. scalenus primal costae*)로 구분되었으며 이들은 각각 背, 腹으로 나누어졌고, 淺部는 제 1늑골 및 제 3~4늑골에서 起始하고 있었다.

4. 肋軟骨間筋은 제 7늑간에서는 양쪽 늑골이 서로 밀접하게 붙어있어 나타나지 않았으며, 제 1늑간 부터 제 6늑간 사이에서는 섬유방향이 거의 수평으로 향하고 있어 內肋間筋의 연장으로 보이고 제 8늑간 부터 마지막 늑간사이에서는 거의 수직으로 향하고 있어 外肋間筋의 연장으로 보인다.