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台灣海域鯨豚哺乳動物肺臟支氣管分枝之研究

(Studies of the bronchial tree and lobular division of the cetacean lung in Taiwan)

一、中文摘要

本研究從台灣海岸擱淺之鯨豚，選取新鮮且能用之鯨豚肺臟供作實驗，共採得並完成以硬乳膠供做鯨豚肺臟之支氣管樹鑄型標本計有：弗氏海豚(*lagenodelphis hosei*)八個，花紋海豚(*Grampus griseus*)三個，侏儒抹香鯨（*kogia simus*)三個、瓶鼻海豚(*Tursiops truncatus*)及露脊鼠海豚(*Neophocaena phocaenoides*)各一個等。完成後之支氣管樹鑄型標本以中久喜正一所建立的支氣管分枝的基本架構，可了解到鯨豚肺臟支氣管分枝和一般路生哺乳動物不同，外觀可分左右二大葉，每大葉由前葉與後葉合而為一，兩側均無中間葉與附葉小支氣管系統。右前葉之右前小支氣管系統是獨立分支自氣管，其餘主支氣管二分支自氣管。

關鍵詞：鯨豚、肺臟、支氣管樹、鑄型、分枝

Abstract

The lungs of eight fraser's dolphin (*Lagenodelphis hosei*), three Risso's dolphin(*Grampus griseus*),three Dwarf sperm whale(*kogia simus*),one bottlenose dolphin(*Tursiops truncatus*) and one finless porpoise (*Neophocaena phocaenoides*) were examinated. The cetacean lungs , unlike those of the other domestic species, are not clearly subdivided by deep interlobar fissures into lobes, although there are occasionally external indications of a lobar arrangement. However, the right and left lung may be bilaterally considered to consist of two lobes, namely an apical (cranial) and a diaphragmatic (caudal). Both lobes are united to form a single one. The middle and accessory lobe bronchioles are lacking on either side. The principal bronchus of right apical lobe is solitary arising from the trachea. Despite of the right apical lobe, the remaining principal bronchi of right and left lobe are bifurcation from the trachea.

Keywords: Cetacean, Lung, Bronchial tree, Cast, Branching

Introduction

The lungs of many mammals including man were examined by Aeby[1], and bronchioles were classified into the dorsal and ventral bronchiole systems. Furthermore, Aeby classified the bronchioles into[1] epiarterial and hypoarterial bronchioles according to the course of the pulmonary artery, and considered the left epiarterial bronchiole, i.e., the left upper lobe bronchiole, to be lacking in the human lung. Huntington[3] also examined many mammalian lungs and considered the left upper lobe bronchiole and left middle lobe bronchiole to have a short common trunk originating from the left bronchus. On the other hand, Jackson and Huber [4] divided the human lung into ten pulmonary segments on either side for the convenience of surgery. They considered the left upper lobe to correspond to the right upper and middle lobes. Externally, however, the right lung consists of the upper and lower lobes, and left lung consists of the upper and lower lobes, the middle lobe being absent.

In veterinary anatomy, the lobular division of Ellenberger and Baum [2] was accepted for a long time. This discriminated the apical, cardiac, diaphragmatic and intermediate lobes in the left lung, except for

the horse lung. However, Seiferle[9] pointed out that the left cardiac lobe by Ellenberger and Baum [2] is part of the apical lobe. At present, this is widely accepted in veterinary anatomy. In this way, the interpretations of the left lung have differed among auyhors.

Therefore, Nakakuki [5,6] examined many mammalian lungs to establish the fundamental structure of the bronchial ramifications. It concluded that the dorsal, lateral, ventral and medial bronchiole systems arise from the dorsal, lateral, ventral and medial sides of both bronchi, respectively. Furthermore, two pairs of bronchioles arise from the lateral sides of the trachea. The cranial lobe bronchioles are the first bronchiole of the dorsal bronchiole system (cranial lobe bronchiole I) and the two bronchioles arising from the trachea (cranial lobe bronchioles II and III). In this way, three cranial lobe bronchioles can be enumerated. However, in general, the cranial lobe can be formed by any one of them. The middle lobe bronchiole is the first bronchiole of the lateral bronchiole system. The accessory lobe bronchiole is the first bronchiole of the ventral bronchiole system. The remaining bronchioles of the four bronchiole systems constitute the caudal lobe [5,6].

In an earlier report, Nakakuki [8] described the main portion of the bronchial tree of domestic animals and striped dolphin. However, from a clinical standpoint, the peripheral portion of the bronchial tree is also necessary. Therefor , Nakakuki [7] has already reported detail of whole bronchial tree of the horse. In this paper, the author deals with the whole bronchial tree of the the Fraser's Dolphin (*Lagenodelphis hosei*) including the peripheral portion.

Materials and Methods

The lungs of eight fraser's dolphin coming from stranding around the Taiwan seashore were used. The lungs of eight fraser's dolphin were injected with latex colloid solution into bronchial tree through the laryngeal cavity and trachea with the aid of a metal syringe. After injection the lungs were placed at room temperature until the injected materials coagulated completely. The soft tissues were them treated with hydrochloric acid (HCl) to obtain hard latex cast models after washing in running water.

Results

The outer contour of whole lung The lungs of the cetacean lung, unlike those of the other domestic species, are not clearly subdivided by deep interlobar fissures into lobes, although there are occasionally external indications of a lobar arrangement. However, the right and left lung may be bilaterally considered to consist of two lobes, namely an apical (cranial) and a diaphragmatic(caudal) (Fig. 1&2).

Bronchial ramifications (Fig. 3, 4, 5, &6.) In the Fraser's dolphin lung. The right and left lungs each form a single lobe. The cardiac impressions are present on the medial side of the areas of the cranial lobe to the cranial portion of the caudal lobe in each side. From the viewpoint of bronchial ramification, the right cranial lobe is formed by the the cranial lobe bronchiole III. This bronchiole arises from the dorsolateral side of the trachea, i.e. the so-called tracheal bronchiole (bronchus), and is divided into cranial (a) and caudal (b) branches. The tracheal bifurcation and origin of the right cranial lobe bronchiole III are comparatively short. The cranial lobe bronchioles I and II are lacking. The right middle lobe bronchiole, i.e. the first bronchiole (L_1) of the lateral bronchiole system, and the right accessory lobe bronchiole, i.e. the first bronchiole (V_1) of the ventral bronchiole system, are lacking. The bronchioles of the dorsal, lateral and medial bronchiole systems arising from the right bronchus constitute the right caudal lobe, in which the lateral bronchiole system (L) is the most developed and has the second (L_2) to eight (L_8) bronchioles. Each bronchiole further divides into dorsal and ventral branches, the latter being more developed than the former. The dorsal bronchiole system (D) has the second (D_2) to seventh (D_7) bronchioles, except for the fourth (D_4) and fifth (D_5). The origins of

the third (D_3) and fourth (D_4) bronchioles are inclined to the medial side. The medial bronchiole system (M) has the fifth (M_5) to seventh (M_7). In the right lower lobe, the ventral bronchiole system (V) has the fifth (V_5) to seventh (V_7), but these three ventral branches are not well developed. Externally, the cranial and caudal lobes are united to form a single lobe.

In the left lung, the cranial lobe bronchioles II and III are absent. The left cranial lobe is formed by the first bronchiole (D_1) of the dorsal bronchiole system (cranial lobe bronchiole I). This bronchiole arises from the dorsolateral side of the left bronchus and divides into the cranial (c) and caudal (d) branches. The cranial branch (c) further divides into dorsal (e) and ventral (f) branches, the dorsal (e) branch further divides two branches, the ventral (f) branch further divides three branches. The caudal branch (d) further divides into dorsal (g) and ventral (h) branches, the dorsal (g) branch further divides two branches, the ventral (h) branch further divides three branches. The latter three branches are well developed, while the former two branches are small. Consequently, the left cranial lobe bronchiole (D_1) has ten branches. The left middle lobe bronchiole, i.e. the first bronchiole of the lateral bronchiole, and the accessory lobe bronchiole, i.e. the first bronchiole of the ventral bronchiole system, are lacking. In the left caudal lobe, the lateral bronchiole system (L) is the most developed and has the second (L_2) to eight (L_8) bronchioles. Each bronchiole arises from the ventrolateral side of the left bronchus and divides into dorsal and ventral branches, as in the right caudal lobe. The left medial lobe bronchiole system (M) has the fourth (M_4) to sixth (M_6). In the left lower lobe, the ventral bronchiole system (V) has the fifth (V_5) only, but the ventral branch is not well developed. The cranial and caudal lobes are united to form a single lobe.

Discussions

The anatomical nomenclature of Ellenberber and Baum [2], namely the apical, cardiac and diaphragmatic lobes in the left lung correspond to the cranial part of the cranial lobe, caudal part of the cranial lobe and caudal lobe, respectively, is currently accepted in veterinary anatomy.

The right cranial lobe bronchiole of the Fraser's dolphin lung corresponds to the right cranial lobe bronchiole III of the fundamental structure of the bronchial ramification of the mammalian lung [7]. This bronchiole corresponds to the right cranial lobe bronchiole of the cow, goat, sheep and pig , respectively [5,6]. However, the right cranial lobe bronchiole III of the Fraser's dolphin seems to be the right cranial lobe bronchiole II, because the distance between the origin of the former and the tracheal bifurcation is shorter than those of the cow, goat, sheep or pig [5,6]. This is due to the fact tracheal bifurcation in the Fraser's dolphin is more cranial than those of the above mammals.

References

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計畫成果自評部份

研究內容與原計畫相符合，達成預期目標。研究成員有學術及應用價值，尤其是目前世界上僅發表條紋海豚一種，本計畫另外完成五種海豚，適合在優良學術期刊發表。另外標本亦可供做教學之用。