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ปีที่ 11 ฉบับที่ 2 เดือน เมษายน – มิถุนายน 2561

นิพนธ์ต้นฉบับ

การเปลี่ยนแปลงลักษณะทางสัณฐานวิทยาของปอดและรอยแยก: ศึกษาร่างดองในภาคตะวันออกเฉียงเหนือของประเทศไทย

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บทคัดย่อ

ปอดเป็นอวัยวะที่สำคัญในทางเดินหายใจประกอบด้วยปอดซ้ายและปอดขวา ลักษณะทางกายวิภาคปกติปอดซ้ายแบ่งเป็นสองกลีบส่วนปอดขวาแบ่งเป็นสามกลีบ แม้ว่าความแปรปรวนทางสัณฐานวิทยาของปอดได้ถูกรายงานมาแล้วในหลายเชื้อชาติ แต่ในคนไทยยังไม่มีรายงานมาก่อน ดังนั้นการศึกษาเชิงพรรณนาครั้งนี้มีวัตถุประสงค์เพื่ออธิบายความผิดปกติของกลีบปอดและรอยแยก ศึกษาร่างดองในภาคตะวันออกเฉียงเหนือของประเทศไทย จำนวน 47 ร่าง ผลการศึกษาพบว่ามีความผิดปกติ ร้อยละ 17.0 ในกลุ่มที่ผิดปกติสามารถจำแนกได้ 4 รูปแบบ คือ L_1R_2, L_2R_2, L_2R_4 และ L_3R_3 โดยพบร้อยละ 12.5, 50.0, 25.0, และ 12.5 ตามลำดับ ความผิดปกติดังกล่าวพบในเพศชายและเพศหญิงเท่ากัน องค์ความรู้พื้นฐานของการเปลี่ยนแปลงลักษณะทางสัณฐานวิทยาของปอดและรอยแยกจากการศึกษาครั้งนี้เป็นประโยชน์อย่างยิ่งต่อรังสีแพทย์ ศัลยแพทย์ นักกายภาพบำบัดและนักกายวิภาคศาสตร์ในการใช้เป็นข้อมูลพื้นฐานในการวินิจฉัย การพิจารณารักษาหรือผ่าตัดปอดสำหรับผู้ป่วยเกี่ยวกับโรคปอดในภาคตะวันออกเฉียงเหนือต่อไป

คำสำคัญ: *การเปลี่ยนแปลงสัณฐานวิทยา, กลีบปอด, รอยแยก*

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Original Article

Morphological Variation of Lung Lobes and Fissures: Embalmed Cadaveric Study in Northeastern, Thailand

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Abstract

Lung is an important organ of respiratory tract, which composed of left and right lungs. In general, the left lung is divided into two lobes, while the right one has three lobes. Although the morphological variations of the lungs have been reported in many races, this document in Thais is very rare. This descriptive study aims to describe the abnormality of lung lobes and fissures. A total number of 47 Northeastern Thai embalmed cadavers were investigated. The results showed that the anomaly of lung lobes and fissures was 17.0%. Abnormalities can be classified into 4 types, namely L_1R_2, L_2R_2, L_2R_4, and L_3R_3, each of which is 12.5%, 50.0%, 25.0%, and 12.5% respectively. The abnormalities are found in males and females equally. The basic knowledge of morphological variation of lung lobes and fissures gained from this study are beneficial for radiologists, surgeons, physical therapists and anatomists to use this basic information in lung treatment consideration for Northeastern Thais.

Keywords: *Morphological Variation, Lung Lobes, Fissure*

Introductions

Lung is an important respiratory organ. During lung development, a part of the lung parenchyma developing from the lobar bronchi is separated from each other by mesoderm. This mesoderm forms the pleura, which lines the surface of each lobe separately, thus giving rise to fissures. Many of these fissures get obliterated, leaving the main fissures in their complete form throughout adult life (Singh & Pal, 2001).

In adults, lung consists of left and right lungs. The left lung is divided into upper and lower lobes by an oblique fissure while the right lung is divided into three lobes by two fissures: the horizontal fissure separating upper and middle lobes, and the oblique fissure separating middle and lower lobes (Figure 1) (Last, 2000; Standring, 2005; Moor & Dalley, 2006). There are many reports on the anomaly of lung lobes (Modgil et al., 2006; Barison et al., 2012; Gebregziabher et al., 2015; Thapa et al., 2017). Although anatomical knowledge of variation of lung lobe is important and helpful for lobectomy and surgical resection, such basic information has never been reported in Thais.

Objective

To describe the abnormalities of lung lobes and fissures in Northeastern Thai embalmed cadavers.

Materials and Methods

The descriptive study was conducted in a gross anatomy laboratory at the College of Medicine and Public Health, Ubon Ratchathani University from 2013 to 2017. The sample size was calculated from the formula for estimating population proportion (Wayne, 1995) using a confidence interval of 95%, and acceptance error of 15% and a prevalence of lung abnormality (absence of horizontal fissure) of 45.2% (Medlar, 1947). Thus, the required sample size was at least 43 embalmed cadavers. However, this study investigated the total human embalmed cadavers all of which were 47 adult subjects from the Northeast of Thailand kindly obtained from the Department of Anatomy, Faculty of Medicine, Khon Kaen University. The dissections of the embalmed cadavers were carried out on the anterior part of thoracic wall. The lobes and fissures of the lungs were observed for presence of variation in morphological feature by one anatomist. The classification is designed based on the side of lung and number of lung lobe within the cadaver. The data were collected by using record keeping form. The descriptive statistics was analyzed by SPSS for Windows (IBM Corp, 2010). The study protocol was approved by the Ethical Review Board of Ubon Ratchathani University (Certificate of approval number: UBU-REC-31/2561).

Results

The total 47 subjects consisted of 27 males and 20 females with ages ranging from thirty-two to ninety-five years old. It was found that all abnormality of lung lobes was 17.0% (8/47) (Table 1). Of those, males and females were found lung anomaly with equal frequency at 50%. The lung abnormality was found in four types as L_1R_2, L_2R_2, L_2R_4, and L_3R_3 and the percentage of abnormal lung types were 12.5, 50.0, 25.0, and 12.5, respectively (Table 2). The individual variation is described as follows:

The L_1R_2 is the abnormality found in the left lung, having only one lobe without the fissure. In the meantime, it was found that the right lung with abnormality showed only two lobes as upper lobe and lower lobe. This incident was separated by oblique fissure. The absence of Horizontal fissure contributes to the missing of middle lobe (Table 3 and Figure 2).

For the L_2R_2, the left lung was found normal, but the right lung appeared abnormal. The right lung abnormality was the absence of horizontal fissure contributing to the missing of the middle lobe (Table 3 and Figure 3A, 3B).

The L_2R_4 is the abnormality found in the right lung having 4 lobes. The right lung showed accessory lobe which was derived from unusual development of pleura contributing to accessory-horizontal fissure running through lower lobe (Table 3 and Figure 4A, 4B).

The L_3R_3 is the abnormality found in the left lung having one more accessory lobe. The horizontal fissure runs through the upper lobe contributing to middle lobe (Table 3 and Figure 5A, 5B).

Discussions

The abnormality Type L_1 showed only one lobe of the left lung (Absence of oblique fissure). This study revealed that the embalmed cadaver had one lobe in the left lung or 2.1% of all subjects (1/47). This is associated with previous studies which found 4.76–15% of the abnormality (Medlar, 1947; Prakash et al., 2010; Dutta et al., 2013; Abhilasha & Charulata 2013; Varalakshmi et al., 2014; Divya et al., 2015; Thapa & Desai, 2016).

The abnormality Type R_2 showed 2 lobes in the right lung. This study revealed that the embalmed cadavers were found the disappearance of horizontal fissure contributing to the missing of the middle lobe of 10.6% (5/47) of the whole subjects. This study is associated with previous studies which found 7.1-45.2% of the abnormality (Medlar, 1947; Meenakshi et al., 2004; Prakash et al., 2010; Abhilasha & Charulata 2013; Varalakshmi et al., 2014; Quadros et al., 2014; Nisha et al., 2014; Gebregziabher, 2015; Divya et al., 2015; Thapa & Desai, 2016).

The abnormality Type L_3 showed three lobes in the left lung. This study found that the embalmed cadavers have middle lobe and clear horizontal fissure. This incident was rarely found in Thailand; however, previous studies have reported the accessory fissure in left lung of Indian population of 14.7% (5/34) and Ethiopian population of 15% (3/7) (Varalakshmi et al., 2014; Gebregziabher, 2015).

The abnormality Type R_4 showed 4 lobes in the right lung. It was found 4.3% (2/47) in this study. This abnormality is rarely found in general. This study is the first report in Thailand, and it is also associated with a previous study found in Ethiopian population (Gebregziabher, 2015). The study found that 8.69% (2/23) of embalmed cadavers had complete accessory fissure dividing lower lobe into 4 lobes in right lung (Quadros et al., 2014) from Indian 2% (1/50) (Vimala et al., 2018) and higher percent of incomplete accessory fissure, for example, 20% (6/20) in right lung of Indian population (Varalakshmi et al., 2014).

Fissures and lobes are derived from the pulmonary development. Fissures are spaces between bronchopulmonary segments or buds in fetal life. Later on they get obliterated except along two planes which persist after birth as oblique and horizontal fissures (Moore et al., 2015). Non-obliteration of some of these spaces is responsible for the presence of accessory fissures (Meenakshi et al., 2014).

Accessory lobe is likely to contribute to the rapid spread of infection and accessory fissures can also be misunderstood as areas of pleural sacs or bullae or linear atelectasis (Godwin & Tarver, 1985). Accessory fissures of the lung are commonly observed in lung specimens, but are often unappreciated or misinterpreted on radiographs and CT scans (Radha & Durai, 2015). In patients with endobronchial lesion, an accessory fissure might alter the usual pattern of lung collapse and pose

difficulty in diagnosing a lesion and its extent by giving an unusual appearance (Glazer et al., 1991).

Incomplete fissures often result in postoperative air leakage.They alter the spread of infection within the lung from one lobe to others. It may cause odd appearances of fluid tacking within the lung (Traver, 1995). The lymphatics of lung drain from pleura towards the hilum. Altered course of oblique fissure would lead to altered course of visceral pleura, thereby changing the arrangement of lymphatic drainage (Dutta et al., 2013). In patients with incomplete fissures, pneumonia may spread to adjacent lobes through the parenchymal continuation. Odd lobar involvement with carcinoma of the lung may be explained on a similar basis (Lavanya & Mallikarjuna-Swamy, 2012). Incomplete fissures always give an atypical appearance of pleural effusion in X-ray. It is also site of post-operative air leakage (Kent & Blades, 1942). Incomplete fissures are leading to preoperative hemorrhage and postoperative complications (Waldhausen et al., 1996).

This anatomical variation knowledge is beneficial for radiologists in terms of interpretation on radiograph and CT scan (Radha & Durai, 2015), regarding anatomists for carefully during routine dissection of cadaver (Tsunezuka et al., 2001; Modgil, 2006; Vimala et al., 2018), it is also meaningful to physical therapists and surgeons for exact diagnosis and modify surgical procedures (Vimala et al 2018).

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Table 1 Characteristics of embalmed cadavers

Characteristics	Embalmed cadavers observed (N=47)	
	Number	Percentage
Year		
2013	8	17.0
2014	8	17.0
2015	8	17.0
2016	13	27.7
2017	10	21.3
Genders		
Males	27	57.4
Females	20	42.6
Lung lobes		
Normal	39	83.0
Abnormal	8	17.0

Table 2 Characteristics of lung lobes abnormalities

Characteristics	Lung lobes abnormality (n=8)	
	Number	Percentage
Year		
2013	1	12.5
2014	0	0
2015	0	0
2016	5	62.5
2017	2	25.0
Genders		
Males	4	50.0
Females	4	50.0
Classification of lung abnormalities		
L_1R_2	1	12.5
L_2R_2	4	50.0
L_2R_4	2	25.0
L_3R_3	1	12.5

Table 3 Classifications of lung lobes abnormalities

Classifications	characteristics			
	Lung lobes		Fissures	
	Left lung	Right lung	Left lung	Right lung
L_1R_2	One lobe	Upper lobe Lower lobe	Absence	Only oblique fissure
L_2R_2	Upper lobe Lower lobe	Upper lobe Lower lobe	Oblique fissure	Only oblique fissure
L_2R_4	Upper lobe Lower lobe	Upper lobe Lower lobe Middle lobe Accessory lobe	Oblique fissure	Oblique fissure Horizontal fissure Accessory-horizontal fissure
L_3R_3	Upper lobe Middle lobe Lower lobe	Upper lobe Middle lobe Lower lobe	Oblique fissure Horizontal fissure	Oblique fissure Horizontal fissure

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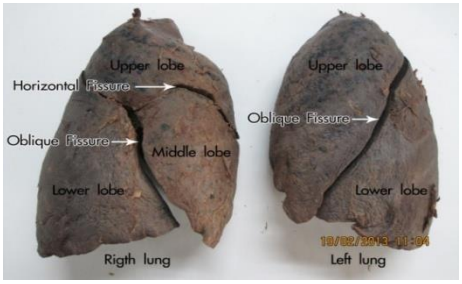


Figure 1 Normal lung (costal surface)

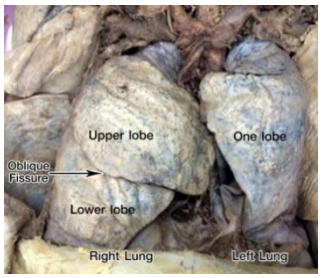


Figure 2 Abnormal lung lobes type L_1R_2

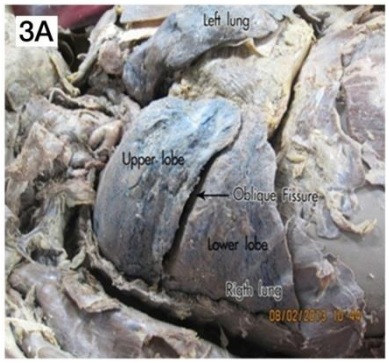
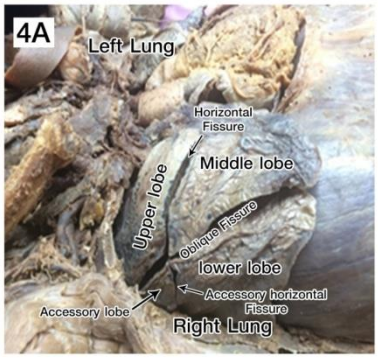


Figure 3 Abnormal lung lobes type L_2R_2



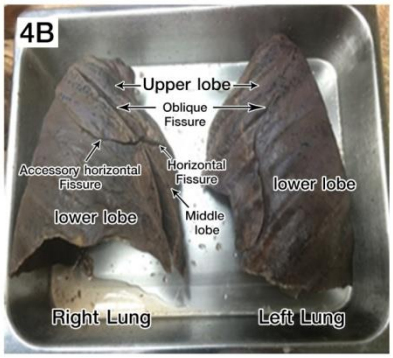


Figure 4 Abnormal lung lobes type L_2R_4

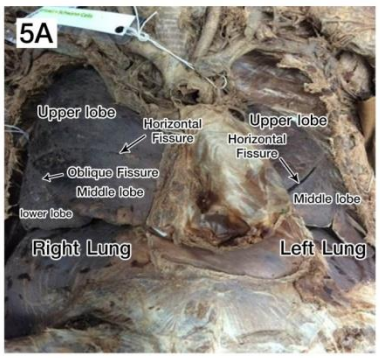


Figure 5 Abnormal lung lobes type L_3R_3