ANATOMICAL VARIATION OF PULMONARY LOBULATION: A CADAVERIC STUDY

VARIAÇÃO ANATÔMICA DA LOBULAÇÃO PULMONAR: ESTUDO CADAVÉRICO

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ABSTRACT

Introduction: Surgeons must be aware of anatomical variations of the lungs during lobar or segmental resections. This knowledge prevents misinterpretation of radiological images when these variations are present. **Objectives:** To investigate the incidence of anatomical variations in the pattern of lobes and fissures of the lungs in human cadavers. **Methods:** Seventy-two human specimens were selected from the cadaveric collection of the Department of Anatomy at the Federal University of Pernambuco. Each lung was analyzed for laterality (right and left), presence of pulmonary fissures, and lobes. **Results:** Of the 72 lungs examined, 35 were right lungs, and 37 were left lungs. The left lungs did not present anatomical variations. Among the right lungs, two anatomical variations were identified in two distinct lungs. In the first case, the horizontal fissure was absent, resulting in only two pulmonary lobes. In the second case, an incomplete horizontal fissure was observed. No other variations were found in the remaining right lungs. **Conclusion:** Two anatomical variations in lobation and fissure patterns were found in the right lungs, corresponding to an incidence of 5.4%. No variations were found in the left lungs.

Keywords: Anatomy; Cadaver; Lung; Anatomic variation

RESUMO

Introdução: Os cirurgiões devem estar cientes das variações anatômicas do pulmão durante as ressecções lobares ou segmentares do pulmão. O conhecimento dessas variações impede a má interpretação das imagens radiológicas quando essas variações ocorrem. **Objetivo:** Investigar a incidência de variações anatômicas no padrão dos lobos e fissuras pulmonares em cadáveres humanos. **Método:** Setenta e dois humanos foram selecionados da coleção de partes de cadáveres do Departamento de Anatomia da Universidade Federal de Pernambuco. Em cada pulmão humano cadavérico foi analisado: lateralidade (direito e esquerdo), a presença de fissuras e lobos pulmonares. **Resultados:** Dos 72 pulmões humanos selecionados, 35 eram pulmões direitos e 37 pulmões esquerdos. Após a análise dos pulmões esquerdos, não foram observadas variações anatômicas quanto à lobulação pulmonar ou quanto às fissuras pulmonares. Na análise dos pulmões direitos, foram observadas duas variações em pulmões distintos. No primeiro caso, não foi observada a fissura horizontal e com isso o pulmão apresentou apenas dois lobos pulmonares, enquanto no segundo caso o pulmão apresentou uma fissura horizontal incompleta. Nos demais pulmões do lado direito não foram observados variações anatômicas quanto aos lobos e fissuras pulmonares. **Conclusão:** Foram observadas duas variações anatômicas no padrão lobar e das fissuras pulmonares no pulmão direito, correspondendo a uma incidência de 5,4%, bem como não foram encontradas variações nos pulmões esquerdos.

Palavras-chave: Anatomia; Cadáver; Pulmão; Variação anatômica

INTRODUCTION

The lungs are paired organs located laterally to the mediastinum, with distinct anatomical and morphological characteristics. The right lung typically presents horizontal and oblique fissures, dividing it into superior, middle, and inferior lobes. The horizontal fissure separates the superior lobe from the middle lobe, while the oblique fissure separates the middle lobe from the inferior lobe. The left lung is relatively smaller than the right due to the presence of the heart and has only the oblique fissure, which divides it into superior and inferior lobes.[1]

Although this is the most observed pattern[2,3], anatomical variations in lobar and fissural configuration must be anticipated and considered in lung morphology.[4,5]

In anatomical science, the term "normal" refers to the structure most often found in a sample population based on statistical data. According to Di Dio (1998), an anatomical variation is a deviation from the typical morphology that does not impair function and is considered within the normality limits.[6,7,12]

Anatomical variation in the arrangement of pulmonary lobes and fissures encompasses a wide range of possible configurations and positional differences. The most frequent alterations observed involve the oblique and horizontal fissures, which may be complete or incomplete, 8-10 potentially resulting in a reduced number of lobes or atypical division of lobes.[2] These variations can lead to misinterpretations or diagnostic errors during imaging examinations.[11] Studies have indicated that the presence of accessory fissures is associated with the spread of respiratory diseases to adjacent lobes due to the continuity of the pulmonary.

Thus, knowledge and disclosure of information regarding anatomical variations of the lungs are essential, as they enhance diagnostic accuracy and effective surgeries. Additionally, this information enriches academic understanding in the medical field, offering valuable insights for interpreting a wide range of clinical scenarios.[6,7]

Although many authors have investigated fissural and lobar variations using imaging techniques, few have done so via gross anatomical studies.[8]

Given the clinical and pathological relevance of these anatomical variations, this study aimed to report cases of morphological variation in the lobar and fissural patterns of the lungs based on a literature review and cadaveric dissection. The motivation for this report was further reinforced by the limited number of studies that describe or compare pulmonary anatomical variations using anatomical and morphometric approaches.

Based on these considerations, this study aimed to investigate the incidence of anatomical variations in the pattern of pulmonary lobes and fissures in human cadavers.

METHODS

Eighty human lungs were randomly selected from the cadaveric specimen collection of the Department of Anatomy at the Federal University of Pernambuco.

Lungs were included if they had dissected pulmonary lobes to allow its visualization, but without the removal of any lobe (i.e., lungs with intact lobes). Specimens were excluded if any pulmonary lobes had been removed or if fissures had been artificially created to expose the lung parenchyma for didactic purposes.

The study was conducted in two phases: (1) screening and selection of suitable lungs and (2) evaluation of pulmonary lobulation in the selected specimens.

Following the screening process, 72 cadaveric lungs were selected for analysis of lobulation. Each lung was assessed for laterality (right or left), and the presence and completeness of pulmonary fissures and lobes were recorded.

RESULTS

Of the 72 human lungs selected, 35 were right lungs, and 37 were left lungs; the latter did not present anatomical variations. Considering the right lungs, two anatomical variations were identified in two distinct specimens. In the first case, the horizontal fissure was absent, resulting in a lung with only two lobes. In the second case, an incomplete horizontal fissure was observed. No additional anatomical variations were found in the remaining right lungs.

Figure 1. Right lungs. A: Lung with normal lobes and fissures. B: Lung with an incomplete horizontal fissure. C: Lung with absence of the horizontal fissure and only two pulmonary lobes.

DISCUSSION

A study conducted in India analyzed variations in pulmonary fissures and lobes using 30 pairs of cadaveric lungs and reported that five right lungs lacked the horizontal fissure, while 19 exhibited a complete horizontal fissure. Additionally, 11 right and 14 left lungs presented incomplete oblique fissures. Two right lungs showed an absence of the horizontal fissure combined with an incomplete oblique fissure. Accessory fissures were observed in three left lungs and one right lung.[13]

A more recent study, conducted in southern India using 30 pairs of cadaveric lungs, identified 12 right lungs with incomplete fissures, seven left lungs with incomplete oblique fissures, two left and four right lungs with accessory oblique fissures, and five right lungs with an absent horizontal fissure. Compared with previous studies, a wide variation in major, minor, and accessory fissures was observed among different global populations.[14]

Bergmann, Afifi, and Miyauchi (2004), in one of their studies on the respiratory system, described a case in which a single pair of lungs was divided into 11 clearly defined lobes by fully developed pleural fissures. However, the lungs have the conventionally described five lobes, not separated by distinct fissures.[15]

Another frequent form of pulmonary variation is the absence of fissures. In a study of 277 lungs, the horizontal fissure was absent in 21% and incomplete in 67% of cases. Incomplete oblique fissures occurred in about 30% of both right and left lungs.[15]

CONCLUSION

Based on the findings, two anatomical variations in the lobar pattern and pulmonary fissures of the right lung were identified, corresponding to an incidence of 5.4%. No anatomical variations were observed in the left lungs.

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