A Study on Intersegmental Septa

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Publications dealing with anatomy of the lung describe only briefly the intersegmental septa, usually referring to them as "intersegmental planes." The existence of such "planes" has been doubted by the authors for years, and an investigation was undertaken by filling cadaver lungs according to the method of Tobin, as follows: 1. In two cases the whole lung was filled with unicolored (white) latex, and 2. In six cases, each segment was filled with a different colored latex. The latex was solidified in 20 per cent formalin.

1. In the unicolored specimens the secondary lobuli were marked on the pleural surface equally by connective tissue both in the intersegmental and the interlobular borders. The segments were not bordered by a thicker connective tissue layer than the lobuli; thus in gross appearance the segmental borders were not recognizable.

2. On the smooth pleural surface of the multicolored specimens the intersegmental borders were marked only by the different colors and zig-zagged according to the angulated lobuli. (Fig. 1. and 2. A.)

After these observations the authors separated the different colored segments in the intersegmental septa and found that the intersegmental surfaces are not plane, even or smooth, but uneven and bumpy like basalt rocks; the irregular surfaces of the pentagon-shaped lobuli of the neighbouring segments fit into each other as a cast fits to the pattern. (Fig 1. and 2. B.) Naturally not all of the intersegmental surfaces are equally uneven. Less angulated surfaces were seen between the two lingular segments and between some basal segments. (Fig. 2. B.; surface between the lateral and posterior basal segments.)

Utilizing the above observations the authors have created a more life-like segmental model, in which the intersegmental unevenness caused by protrusion of the angulated lobuli was imitated. (Fig. 3.)

The above statements have considerable anatomical significance, but they have also some clinical importance:

1. Surgeons find the intersegmental surfaces fairly smooth and plane-like in segmental resections, but this is, as consequence of above statements, because of the collapse of the lobuli. However, a larger lobulus can protrude occasionally into a neighbouring segment (Fig. 2. B.) and create a larger elevation on the surface in spite of its collapse. Overholt and Langer write in their book (The Technique of Pulmonary Resection, 1949) that "With extreme rarity small intersegmental bronchi are encountered." One may ask (a) whether this impression may be the result of unintentional division through the interlobular septum or lobular bronchus projecting from the segment being removed into the adjacent one (or vice versa)? and (b) whether such an occurrence might not explain an otherwise unexplained post-operative bronchial fistula?

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2. In cases of segmental atelectasis x-ray films show the interlobar border of the segmental shadow marked and sharp, but the intersegmental ones indistinct, fuzzy or zig-zag. These findings could be attributed to two reasons:

a. The collateral ventilation may permit air to enter the atelectatic segment near the border through the pores between the alveoli of the neighbouring segments and thus make these surfaces indistinct or fuzzy.

b. An atelectatic segment never collapses like an atelectatic lobe. Atelectasis in a segment occurs only if secretion or excretion occludes the pores and thus obstructs the collateral ventilation. The segments in cases of acute atelectasis do not diminish considerably in size. They shrink only by fibrosis.

In these circumstances according to the above statements the aerated lobuli of the neighbouring segments protrude into the atelectatic segment.

FIGURE 1: Lateral view of a right upper lobe. Each segment is filled with different colored latex and separated in the intersegmental septa. In “A” the segments are in place; in “B” the intersegmental surfaces are seen. Note the lobuli separated by a connective tissue layer and their angulated, zig-zag lines in the intersegmental borders (A), and their angulated protrusion, like basalt rocks, on the intersegmental surfaces (B). “ap.” = apical, “p.” = posterior, “ax.” = axillary and “an.” = anterior.

FIGURE 2: Right lower lobe viewed from the diaphragmatic surface. Made as specimen in fig. 1. Note on both “A” and “B” the pronounced elevation of lobuli of the medial basal segment and on “B” the intersegmental veins. “a.b.” = anterior basal, “l.b.” = lateral basal, “p.b.” = posterior basal and “m.b.” = medial basal.
FIGURE 3: Segmental model of the authors.

FIGURE 4: Lateral chest x-ray film of a seven year old girl. Note distinct and sharp border of atelectatic shadow of the anterior segment in the interlobar (horizontal) fissure and indistinct border in the intersegmental septum.
and make the shadow of the intersegmental border uneven or zig-zag. The same may be observed also in fibrotic shrunken segments. (Fig. 4.)

SUMMARY

With anatomical, experimental studies the authors found that the intersegmental septa are not plane, as they have been described, but uneven and bumpy like basalt rocks. The irregular surfaces of the pentagon-shaped lobuli of the neighbouring segments were found to protrude and fit into each other as a cast fits to the pattern. Utilizing these observations the authors have created a more lifelike segmental model and have given the explanation for some surgical and x-ray observations.

RESUMEN

Después de estudios anatómicos y experimentales los autores encontraron que las divisiones intersegmentarias no son planas como se han descrito, sino irregulares y accidentadas como las rocas de basalto. Las superficies irregulares de los lobulillos de forma de pentágones de los segmentos vecinos se encontró que sobresalen y se adaptan unos a otros como acomodándose a un molde.

Usando estas observaciones los autores han creado un modelo de segmentos más ajustado a la realidad viviente y han dado la explicación de algunas observaciones quirúrgicas y radiológicas.

RESUME

Par des études anatomiques et expérimentales, les auteurs ont constaté que les cloisons inter-segmentaires ne sont pas planes, comme on les a décrites, mais rugueuses et pleines de protubérances comme des roches basaltiques. Les surfaces irrégulières des lobules de formes pentagonales constituant les segments contigus sont protubérantes et constituées de façon à s'encastrer les unes dans les autres, comme un moule s'adapte à l'objet qu'il façonne. En utilisant ces observations, les auteurs ont établi un modèle de segment plus conforme à ce qui existe chez le vivant, et ont donné l'explication de quelques observations chirurgicales et radiologiques.

ZUSAMMENFASSUNG

Anhand von anatomischen und experimentellen Studien ermittelten die Autoren, dass die intersegmentalen Septen nicht plan sind, wie sie beschrieben wurden, sondern uneben und holprig, wie Basaltsteine. Es stellte sich heraus, dass die irreguläre Oberfläche der fünfeckig gestalteten Lobulie der benachbarten Segmente überhängen und sich einander einfügen, wie eine Gussform in das Modell passt. Unter Verwendung dieser Beobachtungen haben die Autoren ein mehr naturgetreues Modell eines Segmentes geschaffen und die Erklärung gegeben für einige chirurgische und röntgenologische Beobachtungen.