Acta Scientific MEDICAL SCIENCES (ISSN: 2582-0931)

Volume 7 Issue 1 January 2023

Review Article

Bronchial Variations in the Lower Left Lung Lobe: About 17 Anatomical Injection-corrosion Pieces

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DOI: 10.31080/ASMS.2022.07.1434

Received: November 19, 2022

Published: December 28, 2022

Abstract

Introduction: There are many anatomical variations in the bronchial distribution of the lower left lung lobe. The control of its variations offers a better guarantee for safe and controlled removal surgery. The objective of this work was to study the bronchial distribution of the lower left lung lobe, to specify its variations and their surgical implications.

Methods: Thus, we operated 17 broncho-arterial moldings made from heart-lung blocks treated by injection-corrosion.

Results: Our results were as follows: the lower lobar bronchus was present in 100% of cases and measured 0.65 cm on average. It ended by giving the apical and basal bronchi. The apical bronchus ended in 64.70% of cases with a bifurcation and in 35.30% with a trifurcation. As for the basal bronchus, it is 1.1 cm long. It gave successively the ventro-paracardiac trunk (TVPC) which bifurcated in 88.23% of cases in baso-medial and baso-ventral bronchi; the baso-lateral bronchus which was typical in 58,82% of cases; and ended with the baso-terminal bronchus in our cases.

Conclusion: This distribution presents many variations which must be taken into account for a quality excision.

Keywords: Broncho-arterial pedicle; Lower Lobe; Left Lung; Variations Surgery

Abbreviations

B6: Apical Bronchus of the Lower Lobe; B7: Baso-medial Bronchus; B8: Baso-ventral Bronchus; B9: Baso-lateral Bronchus; B10: Baso-dorsal Bronchus; LILB: Left Inferior Lobar Bronchus; VPCT: Ventro-paracardiac Trunk

Introduction

Resection surgery in the lung was performed blindly by mass ligation of the pedicle or using a turnstile [9]. Currently, advances in bronchial imaging have improved conventional and interventional surgical practices.

However, the isolated removal of a lung segment requires a perfect anatomical knowledge of the bronchial distribution of the lung. Thus, in recent years, thanks to a better knowledge of the pedicular anatomy of the lung, the surgical technique has been well codified and mastered [10,11].

Usually, the left inferior lobar bronchus (LILB) arises from the bifurcation of the left main bronchus and is divided into segmental bronchi [5]. It is in this context that we carried out this work to study the morphology of the bronchial distribution of the lower left lung lobe. The objectives of this work were to: locate the exact birth of the LILB; Look for anatomical variations during the division of the BLIG into lobar and segmental bronchi and identify possible anatomical specificities related to the Senegalese melanoderma subject and finally, propose ways to control variations of the LILB safely during surgery of pulmonary excision.

Materials and Methods

- **Study design:** This study of the pulmonary bronchial ramification of the lower left lung lobe in humans was based on the exploitation of the molding of the bronchi by the technique of injection-corrosion.
- **Study setting and population:** To do this, we took 17 heart-lung blocks from corpses of adults of both sexes, without trauma or chest-pulmonary macroscopic lesions. The resulting sample was sent to the Anatomy laboratory where it was treated, either immediately or after storage in the freezer between 0 and -4°C. Five pairs of lungs were injected with Rhodopes. The latter was coloured extemporaneous in blue for the pulmonary arteries and colourless for the bronchi. Twelve other pairs of lungs were injected with polyester resin colored yellow for the bronchi and blue for the arteries. The injected parts were corroded in a 30% hydrochloric acid bath for 7 to 10 days. At the end of this period, we obtained a real molding of the bronchial tree and the pulmonary arterial system. Each mold was finely analyzed, specifying the bronchial distribution of the lower left lung lobe. Thus, we studied the topographical relationships of the segmental bronchi of the lower left lung lobe, specifying the situation, the origin, the path, the mode of distribution and the measurements. These were carried out using a tape measure and a compass using the HORSFIELD method [6].

Results and Discussion

Results

The LILB was individualized on all 17 exhibits. From its origin on the posterior-inferior side of the left main bronchus, it was worn downwards, outwards and backwards. Its length was 0.65 cm on average (extremes: 0.4 - 1.1 cm). The LILB branched in monopodic mode, giving birth to the apical bronchus of the lower lobe (B6) before ending in the basal bronchus. We reserved the name of the left lower lobar bronchus with only bronchial trunk between the origin of the upper lobar bronchus and that of the left B6.

The B6 was born from the posterior side of the lower lobar bronchus on all 17 pieces, 0.65 cm on average, from the upper lobar bronchus. Oblique up, back and out, its length was 0.96 cm on average (extremes: 0.7 - 1.3 cm). In 64.70% (11 cases), it bifurcated into an anterior sub-segmental twig and a posterior common stem which in turn gave an external sub-segmental twig and an upper sub-segmental twig (Figure 1). In 35.30% (6 cases), it was sorted into 3 twigs: one upper (internal), one middle (external) and one lower (internal) twig (Figure 2).

Figure 1: Posterior view of the left bronchial tree: Bifurcation of the apical bronchus.

1. Left Main Bronchus
2. Apical Segmental Bronchus (Nelson)
3. Posterior Common Stem
4. External sub-segmental twig
5. Upper sub-segmental twig
6. Anterior sub-segmental twig

Figure 2: Posterior view of the left bronchial tree: Trifurcation of the apical bronchus.

1. Left Main Bronchus
2. Lower lobar bronchus
3. Apical Segmental Bronchus (Nelson)
4. Basal Pyramid Bronchial Trunk
5. Upper segmental bronchus

The basal bronchus of the left lower lobe, between the origins of B6 and the ventro-paracardiac trunk (VPCT), was present in all rooms (Figure 2). Its length was 1.1 cm on average (extremes: 0.5 - 2 cm). In 94.11% (16 cases), it gave birth to its initial part to the VPCT before continuing downward by giving birth to the baso-lateral (B9) and baso-dorsal (B10) bronchi. In 5.89% (1 case), there was no VPCT, and the baso-medial (B7) and baso-ventral (B8) bronchi were born separately.

The VPCT was 1.1 cm from the B6 and 1.89 cm from the upper lobar bronchus. Its length was 1.05 cm on average (extremes: 0.5 - 1.5 cm). It bifurcated, classically, in 88.23% (15 cases), in B7 and B8 (Figure 4). In 5.88% (1 case) it bifurated in B7 and B8 (Figure 3). In 11.76% (2 cases), the presence of a superior sub-apical bronchus was noted on the VPCT.

The B7 had an average length of 1.07 cm (extremes: 0.5 - 2 cm). In all cases, it bifurcated into an anterior and a posterior branch (Figure 4).

The B8 had an average length of 1.15 cm (extremes: 0.7 -1.7 cm) (Figure 3). In 88.23% (15 cases), it bifurcated into an inner and

Figure 3: Posterior view of the left bronchial tree showing the absence of TVPC.

1. Left Main Bronchus
2. Apical Segmental Bronchus (Nelson)
3. Basal Pyramid Bronchial Trunk
4. Paracardiac Segmental Bronchus
5. Baso-ventral Segmental Bronchus.

Figure 4: Inferior-posterior view of the lower left lung lobe.

1. Basal Pyramid Bronchial Trunk
2. Ventro-paracardiac trunk
3. Basal medial bronchus
4. Baso-ventral bronchus
5. Baso-lateral bronchus
6. Baso-dorsal bronchus
7. Apical Segmental Bronchus (Nelson).

an outer branch; in 5.88% (1 case) it bifurcated into an anterior upper trunk and a posterior branch. In 5.88% (1 case), there was upward movement of the 2 internal sub-segmental branches of the B7 and B8.

B9 was born in all cases on the antero-external side of the basal bronchus, 1.04 cm from the VPCT, and 2.94 cm from the upper lobar bronchus (Figure 4).

In 58.82% (10 cases), it had an oblique path down, out and forward, measured 1.16 cm on average (extremes: 0.7 cm to 2 cm); it bifurcated into an upper and lower twig. In 35.30% (6 cases), there was no individualized B9; there was a separate birth on the basal bronchus of 2 usual sub-segmental constituents (with an inner branch at the top and an outer branch at the bottom. The distance between these two branches was on average 0.75 cm (extremes: 0.5 - 1 cm). In 5.88% (1 case), it gave one component of B9 on the VPCT and the other on the basal bronchus.

The B10 corresponds to the branch of termination of the basal bronchus. It was born on the posterior side of the basal bronchus in all cases. Oblique at the bottom, outside and back, its length was 1.58 cm on average (extremes: 0.3 - 2.6 cm). It was separated from the upper lobar bronchus by 3.47cm in 7 cases, and by 2.96 cm in the remaining 10 cases because it had the same origin as B9. Thus, in 6 cases, it was located 1.75 cm from the VPCT and in 11 cases, it was located 1.1 cm from the VPCT, with the same origin as B9.

In all rooms, it bifurcated into outer and inner branches (Figure 5). High sub-apical bronchi were observed in 82.35% (14 cases); and in 5.88% (1 case), we had low sub-apical bronchi.

Figure 5: Posterior view of the left bronchial tree: Bifurcation of the baso-dorsal bronchus.

1. Left Main Bronchus
2. Lower Lobe Apical Bronchus (Nelson)
3. Basal Bronchus
4. Lower Dorsal Bronchus
5. Inner branch of the baso-dorsal bronchus
6. Outer Branch of the Baso-Dorsal Bronchus
7. Pulmonary Trunk.

Discussion

The origin of the B6 of our series is identical to that of NIANE [9] who worked right. Its recovered oblique direction is consistent with the results of CROSLAW TOPOL [17]; while BOYDEN [3], OECONOMOS [13] and NIANE [12] have found a horizontal direction. Our length is slightly longer than that of Cordier [5] (0.6 cm on average) and NIANE [12] (0.8 cm on average). It gives birth to three sub-segmental branches: upper, posterior, external in 15% and 17% of cases respectively in Berg [2] and Amemiya [14]. NIANE [12] (38.5%), Beder [1] (55%) and Brock [4] (93.33%) reported a higher frequency of trifurcation. Cordier [5] finds a bifurcation identical to that of our study. On the other hand, this bifurcation of the B6 is found in 100%, 88%, 75% and 61.5% respectively at Oeconomos [13], Topol [17], Niane [12] and SY [16]. It will have an impact on lung segmentation which will allow to describe the redistribution of parenchyma in front of these variations. The BLIG is therefore different from the right because of the non-existence of the average lobar bronchus to compromise its length; which makes its surgery relatively less difficult [8].

The basal bronchus is present in all cases of our study, as in the series of Cordier [5], its length is identical to that found by the latter. It would facilitate a correct closure of the bronchial stump [5].

The VPCT is born on the anterior face of the basal bronchus both in our series and in that of Cordier [5], however our lengths differ (1.05 cm for us versus 0.9 cm for Cordier). The absence of VPCT in our study, in 1 case, is not found in the literature [5]. On the other hand, the individualisation of the B7 and B8 bronchi was more frequent as described in the work of Berg [2] and SY [16]. This distribution will determine the method of ventilation. Cordier [5] notes the existence of upper subapical bronchi in the order of 14% which is less than the one we found (11.76% of cases).

Our average length of the B7 bronchus is roughly equal to that noted by Cordier [5] whose differences are more variable. Moreover, the bifurcation of the B7, in our study, is identical to that found by other authors [1,5] in the same proportions. However, SY [16] found this bifurcation in 97.5%.

Regarding the B8, its bifurcation is less important in the Cordier series [5], compared to ours.

For the B9, our results are identical to those of Cordier [5] and SY [16]; unlike Berg [2] who found a common core between B9 and B10 in 90% of cases. The B9 bifurcation of the SY study [16] is 95% greater than our study. Thus other authors [2,5] agree with him [16]. In 35.30% of our series, we note a separate birth of the B9 in 2 usual sub-segmental constituents (in situ split of the B9) which is of the order of 10% in the Cordier series [5]. Another less frequent migration (2%) is found in the Cordier series [5], it is the migration of the internal component of the B9 on the TVPC while it is of the order of 5.88% in our series.

Concerning the birth of the B10, our results are superimposed on those of Cordier [5] and SY [16] which also find, a bronchus shorter than ours. As for its B10 termination, SY [16] joins us while Cordier [5] finds a bifurcation. Similarly, we found more lower subapical bronchi than Cordier [5].

Conclusion

Mastery of the pulmonary pedicular anatomy has become a necessity before indications of pulmonary excision. The left bronchial distribution has many anatomical variations due to the frequent sliding and splitting phenomena. In addition to the data of the classical pedicular anatomy, the consideration of these variations is necessary for any surgery of pulmonary excision.

Acknowledgements

The authors wish to thank Professor Assane NDIAYE for the follow-up and encouragement during the redaction of this document.

Conflict of Interest

The authors declare no competing interest.

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