Measurement of Collateral Flow at Quasialveolar Level in Excised Dog Lung

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TAKISHIMA, T., ISHIKAWA, K., SASAKI, T., SASAKI, H. and NAKAMURA, T. Measurement of Collateral Flow at Quasialveolar Level in Excised Dog Lung. Tohoku J. exp. Med., 1971, 105 (4), 405-406 — No collateral flow in dog lung was observed between two distant holes on the pleural surface with the bronchus closed at its bronchiolar level by silicon rubber, which was considered to be not in favor of the assumption that Kohn's pore was the major pathway for collateral ventilation. —— collateral ventilation; lung; Kohn's pore; silicon rubber cast; pleural capsule

It has been widely assumed that the alveolar pores of Kohn are the major pathway for collateral ventilation in the lung. To testify this hypothesis, collateral flow was measured between two distant holes on the pleural surface with the bronchus closed both at its opening and at bronchiolar level under various lung expansion. Figure shows a block diagram of the experiment. The cannulated dog lobe was inflated with positive pressure of 20 cm H₂O.

Three capsules of 5 mm in internal diameter and 15 mm in external diameter were separately cemented with the adhesive substance (Aronalpa, Sankyo, Tokyo, Japan) on the pleural surface of the same or different segment. Each capsule has a main catheter for flow with a side tubing to measure pressure in the capsule. After adhesion completed, we have carefully made with a needle about twenty small and shallow holes on the pleural surface inside of each capsule, a care being taken not to destroy the lung parenchyma to a depth where bronchiolar architecture is significantly involved. After the capsulated lobe had been suspended in the Lucite box with six catheters for measurements of flow and pressure out of the box, positive distending pressure is switched to negative pressure of the same magnitude in the box.

Firstly, resistance of the separated airway was measured in the flow between the opening of the lobar bronchus and one of the capsules with the other two capsules closed. Secondly, collateral flow between two capsules was measured with the lobar bronchus closed at its opening. Finally, under the same condition as the second, lobar bronchi were obliterated roughly at their bronchioles with the silicon rubber (TSE 350-5RTV with appropriate enzyme CE 60, Toshiba, Tokyo,

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TABLE 1. Air-flow resistances of the collateral ventilation

<table>
<thead>
<tr>
<th>Dog No.</th>
<th>Separate airway resistance</th>
<th>Collateral resistance</th>
<th>Obstructed at</th>
<th>Obstructed at</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cap. 1</td>
<td>Cap. 2</td>
<td>Cap. 3</td>
<td>1-2</td>
</tr>
<tr>
<td>1</td>
<td>270</td>
<td>450</td>
<td>270</td>
<td>596</td>
</tr>
<tr>
<td>2</td>
<td>250</td>
<td>170</td>
<td>202</td>
<td>250</td>
</tr>
</tbody>
</table>

Resistance: cm H$_2$O/1/sec. * Capsules in the same segment.

Fig. 1. Block diagram of the experiment.

Japan), which was confirmed microscopically after dissolving the lung tissue with HCl.

Results listed in the Table show the data in 2 dogs under fixed transpulmonary pressure of 20 cm H$_2$O. Collateral resistance between two capsules with the bronchus obstructed at its opening appeared to be approximately twice as high as separated airway resistance. This fact probably suggests that the collateral flow passes the bronchial pathway. It was rather unexpected finding that no flow was seen between capsules when the bronchi were obliterated at their peripheral level even if capsules were located in the same segment. In conclusion, our findings are not in favor of the assumption that Kohn's pore is the major pathway for collateral ventilation.