Creation of a uniform pleural defect model for the study of lung sealants.

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Abstract:

OBJECTIVE: Animal models are indispensable for the development of new therapeutic methods for the closure of alveolar air leakage. However, it is difficult to create a uniform pleural defect model. The purpose of this study was to establish an appropriate animal model for assessing the efficacy and histotoxicity of synthetic sealants for lung surgery.

METHODS: Nine beagle dogs were used to evaluate the pleural defect model in comparison with conventional resection procedures. A donut-shaped silicon ring with an inner diameter of 15 mm was placed on the pleura, and 0.1 mL of cyanoacrylate was dropped into the ring. A pleural defect was created by sliding a microtome blade just beneath the polymerized cyanoacrylate. Hemostasis was performed by pressure with a sponge.

RESULTS: Morphologically, round areas of the pleura were uniformly resected with our procedure. The resected tissue consisted of pleura and thin underlying lung parenchyma. Among the results from 3 surgeons, there were no significant differences in the mean time required for hemostasis ($P = .69$), the mean thickness of the resected tissue ($P = .13$), and the mean amount of air leakage from the resected area ($P = .19$). No penetration of cyanoacrylate into the lung parenchyma was evidenced by immunofluorescence microscopy. Histologically, when the pleura was resected without using cyanoacrylate, a thick fibrocellular layer extended to the lung parenchyma. Furthermore, severe fibrosis was observed when electrocautery was used for hemostasis. However, when the

pleura was resected using cyanoacrylate, the normal alveolar structure was preserved.

CONCLUSIONS: Our uniform pleural defect model using cyanoacrylate may be feasible for the evaluation of synthetic sealants for alveolar air leakage.