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Artificial tumor targets simulating peripheral nodules in isolated pig lung models

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Background

New technologies for the diagnosis and treatment of peripheral pulmonary lesions continues to emerge, and an appropriate model of peripheral pulmonary nodules is helpful for evaluating these new technologies and reducing the risk of clinical trials. Human cadaveric model for peripheral nodules has been described in a few studies, however, animal models has not been reported. This article described our effort to create artificial tumor targets simulating peripheral nodules in isolated pig lungs.

Methods

According to the method of Alexander C. Chen et.al described[1,2], an aqueous solution（Figure 1） was heated to 90° C during mixing and was maintained as solution at 45° C to 50° C before injection. The warmed solution was drawn into a 5-mL syringe and was injected transthoracically into the lung parenchyma or bronchoscopically into the lung periphery through a radial probe guide sheath, respectively. Approximately 3 to 5 mL of this solution was used per artificial tumor target. CT scans were performed following injection using slice thickness of 1 mm. The maximum diameter analysis of simulated tumor targets was performed.

Fig 1. An aqueous solution of 10% gelatin, 2% agar, 0.1% iodinated contrast, and little colored mica powder was heated to 90°C during mixing and was maintained as solution at 45°C to 50°C before injection.

Results

When injected the solution bronchoscopically, it is easy to flow along the bronchus and artificial tumor targets is hard to be created. In contrast, inject the solution transthoracically is a better way. The volume of material injected was recommend controlled within 2-3 ml which could create lesions 10–30 mm in diameter. The injection depth was recommended 1.5-2cm from skin which could provide a heterogenous distribution of peripheral pulmonary lesions. However, most of these lesions were without bronchus sign.

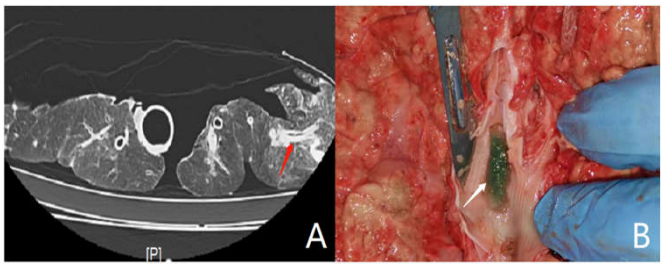

Fig 2. The solution flow along the bronchus (Figure 2A, red arrow) after it was injected bronchoscopically, and artificial tumor targets was not created. The picture taken after cutting open the bronchus was showed in Figure 2B (white arrow).

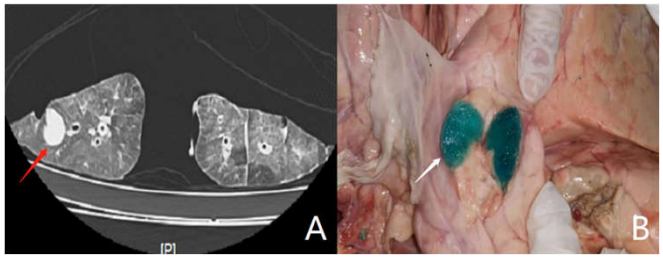

Figure 3 A peripheral artificial tumor target about 20mm in diameter visible by chest CT (Figure 3A, red arrow) was created by inject 3ml solution transthoracically. The picture taken after cutting open the lung was showed in Figure 3B (white arrow)

Conclusions

Artificial tumor targets visible by chest CT could be created in isolated pig lungs, and injection transthoracically may be better than bronchoscopically. However, further effort is still needed to establish an ideal model.

References
1. Chen A, Machuzak M, Edell E, et al. Peripheral Bronchoscopy Training Using a Human Cadaveric Model and Simulated Tumor Targets. J Bronchology Interv Pulmonol 2016;23:83-6.
2. Chen AC, Pastis NJ, Machuzak MS, et al. Accuracy of a Robotic Endoscopic System in Cadaver Models with Simulated Tumor Targets: ACCESS Study. Respiration 2020;99:56-61.