

Feasibility of transtracheal thoracoscopy (natural orifice transluminal endoscopic surgery)

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Video clip is available online.

Successful natural orifice transluminal endoscopic surgery (NOTES) procedures have been reported in animal studies. However, very little is known about the optimal approach for the application of these operations in the thoracic cavity.

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CLINICAL SUMMARY

The Chang Gung Memorial Hospital Ethics Committee on Animal Research approved the protocol. The accompanying video (Video 1) shows a transtracheal exploration of the thoracic cavities of 2 pigs using a sharp metal trocar puncture technique for the tracheal incision and a 9-mm rigid scope for ventilation. During the operation, the lung surface and pleural space were evaluated with a flexible bronchoscope through the working channel of a rigid bronchoscope (n = 2). One pig tolerated the procedure well; it awoke immediately after the operation and was symptom free, even at 2 weeks after the operation. The other animal, however, died from a tension pneumothorax during the operation.

The 6 principal steps of a transtracheal approach are as follows. First, a 4-mm transverse incision is performed on the lateral wall of the lower trachea about 2 cm above the carina by using a homemade metal trocar under rigid bronchoscopic guidance. Second, the tracheal incision was sequentially dilated to 9 mm by using a homemade metal tube. Third, a 9-mm homemade metal tube was inserted

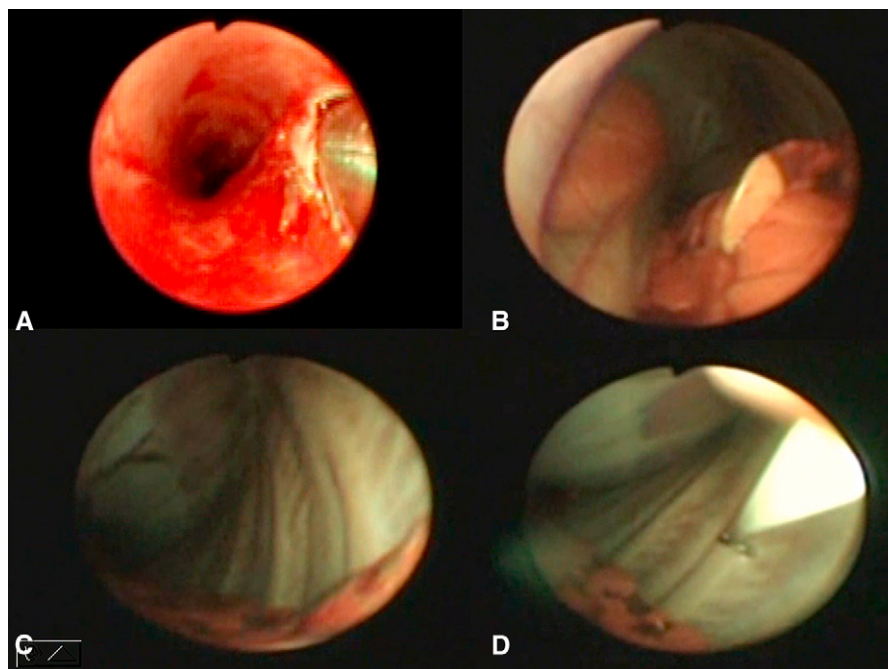


FIGURE 1. A, Endoscopic image of tracheal puncture. B, Endoscopic image of lower anterior mediastinum (left lung, inferior vena cava, and right lung). C, Endoscopic image of posterior costophrenic angle. D, Endoscopic image of pleural biopsy.

through the tracheal incision and used as the entrance to the thoracic cavity. Fourth, the flexible bronchoscope was introduced into the thoracic cavity through a 9-mm metal tube for evaluating the lung, mediastinum, and pleural space. Fifth, the rigid scope was withdrawn from the thoracic cavity, and we evaluated for thoracic organ injury. Finally, the tracheal incision was sealed with fibrin glue (Figure 1 and Video 1).

DISCUSSION

NOTES was performed by making an incision in a wall of the lumen and therefore avoiding skin incisions and wound discomfort. Although some series of NOTES for intra-abdominal operations have been reported, very few series of NOTES for intrathoracic operations have been published, and to our knowledge, none have been published with a transtracheal approach to the thoracic cavity.¹

The rigid bronchoscopic procedure is the most common mode of treatment for patients with central airway disease. Apneic anesthesia with intermittent ventilation during bronchoscopic procedures provides a safe surgical environment to explore the airway.² Our results showed that intermittent

ventilation is a feasible and efficient modality for transtracheal approach during NOTES.

Wound closure and complications involving leaks are the most important concerns in NOTES. Conservative treatment can efficiently control minor injuries, whereas surgical closure is mostly required for severe injuries.^{3,4} The data indicate that transtracheal evaluation of the thoracic cavity is feasible in porcine models. We believe that this approach is worthy of further investigation, and the secure sealing of the tracheal incision should be first investigated in the transtracheal NOTES approach.

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