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Title

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Permalink

<https://escholarship.org/uc/item/4rt88021>

Journal

CHEST Journal, 148(4)

ISSN

0012-3692

Authors

Ochoa, Sebastian

Dehghani, Bijan

Cheng, George

et al.

Publication Date

2015-10-01

DOI

10.1378/chest.2275576

Peer reviewed

Evaluation of Lung Sealants as Suture Replacements in an Ex Vivo Pig Model

Sebastian Ochoa, MD; Bijan Dehghani, MS; George Cheng, MD; Jennifer Wilson, MD; Adnan Majid, MD; Nasim Annabi, PhD; Ali Khademhosseini, PhD; Sidhu Ganghadaran, MD
Beth Israel Deaconess Medical Center, Boston, MA

Chest. 2015;148(4_MeetingAbstracts):38A. doi:10.1378/chest.2275576

Abstract

SESSION TITLE: Thoracic Surgery

SESSION TYPE: Original Investigation Slide

PRESENTED ON: Wednesday, October 28, 2015 at 04:30 PM - 05:30 PM

PURPOSE: Postoperative airleak may occur following 30-50% of lung resections, with up to 15% being classified as prolonged. Patients with prolonged airleak are at increased risk for infectious and other complications, increased hospital costs and lengths of stay. Efforts to reduce airleak have led to development of various sealants which have been used as an adjunct to standard closure techniques with sutures or staples. This study aims to test the performance of different sealants without sutures in mechanically ventilated explanted pig lungs with standardized pleural defects.

METHODS: Explanted pig lungs were evaluated for airleak after creation of 1 cm circular defects in the visceral pleura. Airleak was confirmed by submerging in PBS. Pleural defects were sealed using Evicel (fibrin-based), Bioglue (two-part hydrogel glue consisting of bovine serum albumin and glutaraldehyde), Progel (two-part hydrogel glue consisting of human serum albumin and polyethylene glycol), or sutures (2 layered running horizontal mattress and simple closure). Lobes were then selectively ventilated for 2 minutes at an airway pressure of 10 cmH₂O, PEEP of 0, and respiratory rate of 12. Airway pressure was increased by 5 cmH₂O at 2-minute intervals. Lungs were submerged in a water bath containing PBS at 37°C to test for airleak at each interval. This process was continued till airleak was observed or a maximum airway pressure of 50 cmH₂O was reached. Our primary endpoint was bursting pressure (BP), defined as the minimal peak pressure at which gas bubbles were observed. One-way ANOVA and post-hoc Tukey tests were used to compare groups.

RESULTS: A total of 12 lungs were evaluated and 20 lobes were selected. Bioglue demonstrated the highest sealing efficacy, with no bursting in any samples after reaching peak pressures of 50cmH₂O (n=3, p<0.0001). There were no significant differences in BP between sutures, Progel and Evicel.

CONCLUSIONS: Our study suggests that Bioglue had the highest sealing efficacy, although it is not currently approved as a pleural sealant. Progel, the only approved pleural sealant on market, had similar sealing efficacy to sutures.

CLINICAL IMPLICATIONS: To our knowledge, this is the first study to evaluate the performance of lung sealants as alternatives to sutures in an *ex vivo* airleak model. *In vivo* animal models are needed to further explore these findings.

DISCLOSURE: The following authors have nothing to disclose: Sebastian Ochoa, Bijan Dehghani, George Cheng, Jennifer Wilson, Adnan Majid, Nasim Annabi, Ali Khademhosseini, Sidhu Ganghadaran

No Product/Research Disclosure Information