Western European Journal of Medicine and Medical Science
Volume 4, Issue 05, March 2026
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

A NEW METHOD OF SUTURE SEALING IN LUNG SURGERY: CLINICAL EFFICIENCY AND IMPLEMENTATION PROSPECTS

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Abstract
A comparative clinical study involving 275 patients demonstrated the high effectiveness of this new approach in reducing complications, drainage duration, and postoperative hospital stay.This article presents the clinical experience of applying a new method of suture sealing during lung surgery using the Hemoben biogel. The method is based on intraparenchymal injection of a gel substance into the area of tissue damage and aims to achieve reliable aerostasis and hemostasis.
Keywords: Suture sealing, aerostasis, hemostasis, Hemoben, intraparenchymal injection.

Introduction

These complications delay recovery, extend pleural drainage duration, increase the length of hospital stay, and sometimes necessitate reoperation. Existing sealing techniques-sutures, fibrin glues, synthetic sealants, and polyglycolic acid sheets-often seal only the surface and fail to effectively address deep intraparenchymal defects, especially in vascular and bronchial areas. Against this backdrop, the study introduces a novel method: intraparenchymal injection of the domestic Hemoben gel directly into the damaged lung tissue. One of the key factors affecting the postoperative course in thoracic surgery, particularly in lung operations, is the adequate achievement of aerostasis and hemostasis. Lung surgery is frequently complicated by air leaks and bleeding, especially when dealing with fragile pulmonary parenchyma. Studies indicate that intraoperative air leaks are observed in up to 75% of lung surgeries, with persistent postoperative leaks (>5 days) occurring in 8–20% of cases. This approach provides internal sealing and hemostasis by acting directly on small bronchioles and vessels, offering a potentially superior alternative to conventional surface methods. Damage to lung parenchyma during resection or organ-preserving procedures often leads to air leakage, forming an alveolo-pleural fistula. According to modern literature, intraoperative detection of air leaks can reach up to 75%, and persistent postoperative air leakage lasting more than 5 days occurs in 8–20% of cases [2,8,11]. These complications significantly hinder recovery, prolong pleural drainage, and lengthen hospital stay. In some cases, reoperations become necessary. Existing approaches to sealing lung tissue include various suture techniques, synthetic and biological sealants, fibrin glues, collagen matrices, and pleurodesis [1,12,15]. However, most of these methods only seal the surface and do not effectively address deeper defects, particularly in highly vascularized and bronchial areas.Recent meta-analyses and expert consensus highlight the need for novel solutions to eliminate intrapulmonary air leaks reliably [7,19]. Currently, there is no universal sealant that combines biocompatibility, ease of use, accessibility, and proven effectiveness for intraparenchymal application.In this context, we developed and introduced a new method for sealing sutures during lung surgery based on

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injecting a gel substance made from domestic Hemoben directly into the damaged lung parenchyma. Unlike previous techniques, this method ensures sealing from within the tissue, achieving local aerostasis and hemostasis through direct action on small bronchioles and vessels [3,5,13,17].The objective of this study is to evaluate the clinical efficacy of the proposed intraparenchymal sealing method compared to conventional approaches and to substantiate its feasibility for routine use in thoracic surgery for benign pulmonary conditions [2,13].

Aim of the study:

1.To evaluate the clinical efficacy of the new intraparenchymal suture sealing method in reducing postoperative complications, air leakage, and hemostatic failure during lung surgery.

2.To compare the outcomes of the proposed method with conventional techniques in terms of drainage duration, hospital stay, and the need for additional interventions.

MATERIALS AND METHODS

A total of 275 patients with benign lung pathology underwent either open or thoracoscopic surgery. The study group included 131 patients treated with the new technique, while the control group comprised 144 patients treated with standard methods.The Hemoben gel was prepared by mixing 1 g of powder with 30 ml of saline and injected into the lung parenchyma up to a depth of 5 mm in the damaged area. Aerostasis was reassessed 2–3 minutes after injection.

RESULTS

Intraoperatively: significant air leakage (Macchiarini grade 2–3) decreased from 16.7% to 3.8% ($p<0.001$);
hemostatic failure decreased from 16% to 3.1% ($p<0.001$);
the need for additional interventions decreased fivefold.
Postoperatively: the rate of complications (Clavien-Dindo grade II–V) decreased from 13.2% to 3.1% ($p=0.003$);
average drainage duration decreased from 5.0 to 3.8 days ($p<0.05$);
hospital stay was reduced from 7.3 to 6.4 days ($p<0.05$).

DISCUSSION

The proposed method demonstrated clear clinical advantages over traditional sealing techniques. Its primary benefit lies in intraparenchymal action, allowing effective sealing of deep tissue defects that are not addressed by surface-based methods.The significant reduction in air leaks and bleeding suggests that Hemoben gel provides both mechanical sealing and biological interaction with lung tissue. This contributes to improved postoperative recovery and reduced complication rates. Additionally, the technique is simple, cost-effective, and applicable in both open and minimally invasive surgery. Unlike imported sealants, Hemoben is a domestically produced material, increasing accessibility and economic feasibility. These findings support the growing need for innovative solutions in thoracic surgery aimed at minimizing postoperative complications and improving patient outcomes.

CONCLUSION

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Intraparenchymal injection of Hemoben gel provides effective sealing of damaged lung tissue, significantly reducing the risks of air leaks and bleeding. The method is applicable to both manual and mechanical sutures and is suitable for both open and minimally invasive procedures. An additional advantage is the low cost and accessibility of the domestic Hemoben preparation.The proposed technique has demonstrated high clinical efficacy in achieving aerostasis and hemostasis during lung surgery and reducing postoperative complications and hospital stay. It is recommended for widespread adoption in thoracic surgery.

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