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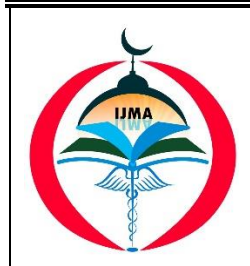
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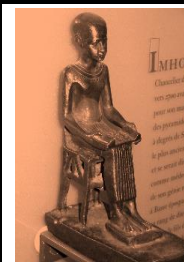
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## Original Article

# Role of Surgical Glue in Persistent Air Leak in Spontaneous Pneumothorax

Mohamed Attia Elkahely\*<sup>[1]</sup>, Gamal Abdelshafy Ibrahim Farag<sup>[2]</sup>; Abdallah Nosair<sup>[3]</sup>

<sup>1</sup> Department of Cardiothoracic Surgery, Faculty of Medicine for Girls, Al-Azhar University, Egypt.

<sup>2</sup> Department of Cardiothoracic Surgery, Damietta Faculty of Medicine, Al-Azhar University, Egypt.

<sup>3</sup> Department of Cardiothoracic Surgery, Faculty of Medicine, Cairo University, Egypt

## ABSTRACT

### Article information

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\*Corresponding author

**Email:** [dr.m.elkahely@gmail.com](mailto:dr.m.elkahely@gmail.com)

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**Background:** Surgical glue [synthetic cyanoacrylic glue] is a sealant material used in treatment of persistent air leak in primary, secondary and recurrent spontaneous pneumothorax after repair of bronco pleural fistula by synthetic sutures as polypropylene or polydioxanone materials.

**The aim of the work:** We aimed to evaluate the effect of surgical glue in treatment of cases of persistent air leak after surgical repair in comparison to surgical repair only.

**Patients and Methods:** A retrospective analysis was performed of 21 patients who underwent surgery for persistent air leak at our department in Al Zahra and Dar Elhekma hospital from May 2015 to December 2018 where age ranges from 32 to 55 and they were 4 females and 17 males, surgical glue used in a group of patients [group A] and another patients as a comparison group without using the glue [group B]. 11 patients were treated by excision of blebs or bullae with closure of feeding bronchus by synthetic sutures with application of surgical glue and 10 patients were treated by excision only without application of glue.

**Results:** Thoracotomy done in all patients via posterolateral thoracotomy. Operative time, chest tube removal, and hospital stay were significant in group A versus group B. Superficial wound infection in one case in group A without mortality in both groups, one case of persistent air leak and 4 cases of recurrent pneumothorax within two years of follow up in group B.

**Conclusion:** Use of surgical glue [sealant] applied in reducing air leak associated with spontaneous pneumothorax and in recurrent pneumothorax was safe and effective.

**Keywords:** Bronchopleural fistula; Air leak; Pneumothorax; Surgical Glue; Cyanoacrylic; Thoracotomy.



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## INTRODUCTION

Primary spontaneous pneumothorax [PSP] is a condition occurring more commonly in tall, athletic, smoker younger patients usually without underlying lung disease<sup>[1-3]</sup>.

The reported incidence is 7.4 - 18 per 100,000 males and 0.5 to 6 per 100,000 females<sup>[4,5]</sup>.

The recurrence rate is up to 30%. Secondary spontaneous pneumothorax occurring in older

patients with lung diseases as chronic obstructions pulmonary disease, cystic fibrosis emphysema and cavitory infection<sup>[8,9]</sup>.

Pulmonary air leaks are relatively common clinical problem approximately 21 cases of spontaneous pneumothorax, 17 cases were men, and 4 cases were female. The rate of recurrence for spontaneous pneumothorax was 19% cases [4 cases]. If air leak continues to be present for more than 4 or 5 days, a bronchopleural fistula may develop which carries a high rate of morbidity and

mortality and is associated with prolonged hospital stays. Treatment options for pulmonary air leaks most frequently involve conservative, placement of chest tubes large enough to allow sufficient to relieve air, Video Assisted Thoracoscopic Surgery, and Thoracotomy [10-13].

Thoracotomy was used in patients in which surgical sealant [glue] applied to suture lines after repair by synthetic sutures. Surgical sealant [a synthetic cyanoacrylic surgical glue modified by addition of a monomer synthesized by manufacturer has been used in surgery for some time and seems to be potentially useful in cardiothoracic surgery. In contact with the living tissues, it polymerises in a rapid manner, to generate a thin elastic film of high tensile strength that warrants firm adherence to tissues. In 1978, Scheele and colleagues used fibrin sealants in the treatment of recurrent spontaneous pneumothorax [10-13]. However, the studies on its safety and efficacy in comparisons to surgery are inconsistent.

### THE AIM OF THE WORK

We aimed to investigate the role of surgical glue in treatment of cases of persistent air leak after surgical repair in comparison to surgical repair only.

### PATIENTS AND METHODS

A retrospective analysis was performed of 21 cases who represented to AL-Zahraa and Dar El-Hekma hospitals by spontaneous pneumothorax in the period between May 2015 to December 2018.

History, clinical examination and laboratory investigations were done after that plain X-ray and computed tomography [CT] on chest which revealed jet black opacity diagnosed as pneumothorax. After admission, a chest tube thoracostomy was performed, no history of trauma, but 4 patients were COPD and bronchial asthma [19%].

Recurrent pneumothorax was in 4 patients only [19%]. All patients showing persistent air leak after 4 or 5 days which was massive and surgical interventions considered.

Open thoracotomy is a major surgery requiring general anesthesia [GA] and insertion of endotracheal tube, and the procedure was completed while the patient on mechanical ventilation.

#### Positioning:

The lateral decubitus position, with optimal

exposure of thoracic cavity was used. A roll was used and placed under the axilla of the dependent side to release the brachial plexus pressure.

#### Incisions:

The posterolateral thoracotomy approach was used, as it provides the best exposure of the thoracic cavity. A skin incision was drawn followed by dissection of the subcutaneous tissues and the latissimus dorsi muscle using electrocautery. Also, serratus anterior was divided using electrocautery. The thoracic cavity was reached through the fourth or fifth intercostal spaces.

#### Procedures:

Adhesions between parietal and visceral pleura, [usually present. These adhesions were carefully dissected to prevent destruction of the blood vessels and lung.

Blebs or bullae were repaired by surgical sutures by polypropylene or polyglycolic acid materials, then surgical glue was applied on suture lines for reinforcement and to avoid parenchymal air leakage.

The glue was applied drop by drop with an insulin syringe and needle. Pleural cavity is filled with water, while re expansion of the lung takes place in order to check the air leak and partial apical pleuroectomy was performed.

Anatomical closure of the wound after introduction of two chest tubes [one anterior and the other posterior] was performed. All patients extubated immediately in the operating theatre.

#### Statistical Analysis:

Collected data were coded to conceal subject identity. Then, fed to a personal computer and analyzed by a specific software package [Statistical Package for Social Science] [IBM®SPSS®, Chicago, IL, USA] version 23. The arithmetic means and percentages were used to represent the discrete data, while qualitative data were presented by their frequency and relative percentages. Chi square, Fisher exact, independent samples "t" and Mann-Whitney tests were used as tests of comparison as appropriate according to the type of data. P value < 0.05 was considered significant to interpret results.

### RESULTS

This study included 21 patients with spontaneous pneumothorax in the period between May 2014 to

December 2020 in El Zahraa and Dar el hekma hospitals and all patients sign the informed consent and the patients with iatrogenic or traumatic pneumothorax were excluded from the study.

Patients were divided into 2 groups. Group A patients with surgical glue [11] patients, group B patients without glue [10] patients. There were 17 males [81%] and 4 females [19%].

In group A [9] males [82%] and 2 females [18%], in group B [8] males [80%] and [2] female [20%]. The age was between 32-55 years old, age in group A was 32-54 years old, while in group B was 45-55 years old. Cigarette smoking was present in 17 patients [81%], in group A was 9 patients while in group B was 7.

Thoracotomy was carried out in all patients, 11 patients left posterolateral and 10 patients were right posterolateral thoracotomy, in group A [6] left posterolateral and [5] right posterolateral, in group B [5] left posterolateral and [5] right posterolateral, operative time was [50-85mins], in group A was [50-

65 minutes], in group B was [60-85mins], one case was superficial wound infection in group A, no mortality in both groups. Hospital stay was [5-6 days] in group A, mean was [5.5 days], while in group B it was [5-9 days] and mean was [7 days], four cases recurrent pneumothorax in group B through follow up within 2 years from discharge.

Table [1] showed that, there was no statistically significant difference found between the two studied groups regarding gender or smoking with p-value = 0.916 and 0.695 respectively while there was statistically significant difference between them regarding age with p-value < 0.01.

Table [2] shows that there was no statistically significant difference found between the two studied groups regarding site of thoracotomy, superficial wound infection, persistent air leak and re-exploration while there was statistically significant difference found between them regarding operative time, hospital stay, chest tube removal and recurrent pneumothorax with follow up.

**Table [1]:** Demographic and characteristics of the studied groups

		Group A	Group B	Test value	P-value	Sig.
<b>Gender</b>	Male	9 [81.8%]	8 [80.0%]	0.011*	0.916	NS
	Female	2 [18.2%]	2 [20.0%]			
<b>Age</b>	Mean±SD	46.5 ± 5.33	50.3 ± 2.5	2.055*	0.054	NS
	Range	32-54	45-55			
<b>Smoking</b>	Yes	8 [72.7%]	8 [80.0%]	0.153*	0.695	NS
	No	3 [27.3%]	2 [20.0%]			

\*: Chi-square test; •: Independent t-test; NS: non-significant

**Table [2]:** Descriptive data of the surgical interventions in the study

		Group A	Group B	Test value	P-value	Sig.
<b>Site of thoracotomy</b>	Right	5 [45.5%]	5 [50.0%]	0.043*	0.835	NS
	Left	6 [54.5%]	5 [50.0%]			
<b>Type of thoracotomy</b>	Posterolateral	11 [100.0%]	10 [100.0%]	NA	NA	NA
<b>Operative time [min]</b>	Mean±SD	57.52±4.22	72.54±5.67	6.931*	<0.001	HS
	Range	50-65	60-85			
<b>Hospital stays [days]</b>	Mean±SD	5.5 ± 0.25	7.3±1.32	4.447*	<0.001	HS
	Range	5-6	5-9			
<b>Chest tube removal [days]</b>	Mean±SD	3.75±0.85	4.68±0.42	3.125*	0.006	HS
	Range	3-5	3-6			
<b>Superficial Wound infection</b>		1 [9.1%]	0 [0.0%]	0.955*	0.328	NS
<b>Mortality</b>		0 [0.0%]	0 [0.0%]	NA	NA	NA
<b>Persistent air leak</b>		0 [0.0%]	1 [10.0%]	1.155*	0.282	NS
<b>Recurrent pneumothorax with follow up</b>		0 [0.0%]	4 [40.0%]	5.435*	0.019	S
<b>Rexploration</b>		0 [0.0%]	1 [10.0%]	1.155*	0.282	NS

\*: Chi-square test; •: Independent t-test

## DISCUSSION

Surgical glue is a synthetic material used in treatment of spontaneous persistent air leak and recurrent pneumothorax after surgical repair by polypropylene or polyglycolic acid sutures. Sealing and reinforcement of sutures or staples in lung

resections or bullectomies. Sealing of bronchial and bronchopleural fistula. Drainage of the air from the pleural space and prevention of recurrence are the main goals of treatment. All patients with symptoms should be managed with chest tube for drainage, surgical treatment options include open thoracotomy or video assisted thoracoscopic surgery, but our technique is open method after 4 or 5 days because

of persistent air leak for resection of blebs or bullae to treat underlying defect as the study of Inderbitzi and associates [12, 14,15]

Patients with primary spontaneous pneumothorax were young [81%] male population, while in Secondary spontaneous pneumothorax patients were older male [19%] population. Chew et al studied 116 patients with PSP treated in an Australian tertiary hospital, male population accounted for 75% of patients and the mean age was 37 years [16-19]

Surgery was performed on 21 patients [17 males and 4 females]. Indications for surgery were recurrent pneumothorax in 4 cases, persistent air leak in 17 cases for more than 4 or 5 days, as in the study of Bertrand and associates [20].

Time of operation in our study was around 50-85 minutes. It was 50-65 and 60-85 minutes for group A to group B respectively with highly significant p value [p value 0.001].

It was around 86 minutes in another study of Davies [21] and Ong and associates [22].

In our study application of surgical glue in decreasing the recurrence rate of pneumothorax was significant [0%] to [40%] for group A to group B respectively with significant p value [0.019] after follow up for 2 years and more. We performed pleural abrasions with resection and application of glue. In our study persistent air leak after surgical intervention was 0% to 10 % without significant in both groups but chest tube removal after operation was range [3-5] to [3-6] days for group A to group B respectively with highly significant p value [0.006].

The study of Kumbasar *et al.* [23] revealed postoperative air leak 10.5% in patients with fibrin glue application to 18.2% in patients without glue [p= 0.668] and removal of chest tube range from 2-6 days to 2-14 days in patients using glue versus without glue with p value [0.05].

Moser *et al.* [24] also used fibrin glue after lung volume reduction surgery for reinforcement of the staple lines to decrease prolonged air leak.

In our study one case of group A showed superficial wound infection and another case show continuous air leak and reopened after failure of pleurodesis with glucose 10% and another repair done with application of surgical glue in group B, without mortality in both groups.

## Conclusion:

Use of surgical [sealant] glue intraoperative after surgical repair of blebs or bullae on suture lines to avoid parenchymal leakage in cases of spontaneous pneumothorax either primary or secondary or recurrent cases of pneumothorax was safe and effective in decreasing mortality and hospital stay and recurrence rate.

**Study limitations:** The main limitation of the current work is the small number of included subjects, which was an inevitable limitation due to financial issues and incidence of the disease. The second limitation is the retrospective nature of the study. Thus, future prospective studies with higher number of patients are warranted.

## Financial and non-financial activities and relations of interest

Authors declare that there was no conflict of interest. The research funded by the researchers themselves.

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