

## **Efficacy of intra Pleural streptokinase injection in Post traumatic Clotted Hemothorax.**

### **Abstract**

**Background:** Post traumatic clotted hemothorax is a serious problem associated with the presence of fluid loculation by fibrous adhesions, trapped lungs and increased the risk of infection and empyema. Intrapleural instillation of streptokinase may dissolve fibrin clots and membranes, break down adhesions and facilitate complete evacuation of residual blood clots and loculated effusions especially if given in the 1<sup>st</sup> 7days post trauma.

**The aim** of this study is to evaluate the effect of streptokinase injection as a fibrinolytic drug treating patients with clotted hemothorax within and after 1-week post trauma.

**Methodology** of this study included 60 patients randomly divided into 2 groups: Group A: include 30 patients with clotted hemothorax receiving streptokinase from 3rd to 7th day post trauma and Group B: include 30 patients with clotted hemothorax receiving streptokinase after 1-week post trauma.

**Conclusion:** Intrapleural streptokinase injection could be an ideal option for post-traumatic clotted hemothorax before the decision is made to proceed to VATS or thoracotomy especially if given in the 1<sup>st</sup> 7 days post trauma.

**KEYWORDS:** Clotted hemothorax, Intrapleural streptokinase injection, Time of chest trauma.

### **Introduction**

Hemothorax defined as bleeding into pleural cavity which contains a hematocrit value of at least 50% of the hematocrit of peripheral blood. Hemothorax may be caused by spontaneous, iatrogenic or post traumatic. <sup>(1)</sup>

Thoracic trauma occurs in 60% of the polytraumatic cases in which the occurrence of hemothorax related to trauma approaches 300,000 cases per year. Moreover, 25% of traumatic deaths are related to post traumatic hemothorax, which occur as a result of intra pleural or extra pleural injuries. <sup>(2)</sup>

Tube thoracostomy is commonly adequate for the initial management of hemothorax. However, failure of tube thoracostomy causes clotted hemothorax in 5% to 30% of cases. <sup>(3)</sup>

The clotted hemothorax should be evacuated within 7 to 10 days of injury however, the hemothorax is not evacuated by the 10th day, clotted blood cannot be easily removed and the decortication will be required at later days (within 4th or 5th weeks). <sup>(4)</sup>

The complications of non-treated hemothorax are associated with fibrin threads formation on the surface of pleura with an obvious proliferation fibroblastic and angioblastic cells and transformed to fibrothorax due to inflammatory exudates covering of visceral and parietal pleura and reduces the ability of lung ventilation. <sup>(5)</sup>

Streptokinase (SK) is anti-thrombotic drug that acts on the fibrinolytic system. Streptokinase was obtained naturally from Beta hemolytic streptococci and used to break

down clots in some cases of myocardial infarction, pulmonary embolism by injection into a vein. <sup>(6)</sup>

Administration of intrapleural SK in clotted hemothorax has high success rate about 92-94% as it helps in rapid removal of clot before formation of pleural thickening and adhesion leading to avoidance of surgical decortication. Complete response (CR) was defined as resolution of symptoms with complete drainage of fluid and no residual space radio graphically. Partial response (PR) was defined as resolution of symptoms with a small pleural cavity. Non responders (NRs) were patients who underwent decortication. <sup>(7)</sup>

### **Patient and Method**

This study is a prospective single blinded randomized study was conducted on (60) patients with post traumatic clotted hemothorax between April 2019 to April 2020 at Cardiothoracic Surgery Department in Benha University Hospitals.

Patients in the study divided into 2 groups: 1) Group A: include 30 patients with clotted hemothorax receiving streptokinase from 3rd to 7th day and 2) group B: include 30 patients with clotted hemothorax receiving streptokinase after 1 week.

Inclusion criteria were as follows: Patients at any age of both genders, patients with thoracic trauma < 10 days, patients post traumatic hemothorax with failed complete pleural drainage after 3 days by chest tube. patients with post-operative residual hemothorax > 3 days and CT chest showing retained hemothorax after initial placement of tube thoracostomy > 3days.

Exclusion criteria were as follows: patients sensitive to streptokinase, significant associated intra-abdominal or another organ disease, patients with coagulopathy, patients with severe medical diseases like liver cirrhosis, chronic obstructive pulmonary disease, and multi-organ failure, patients with renal failure and patients with bronchopleural fistula.

The procedure done through tube thoracostomy under complete aseptic conditions by small incision at 5<sup>th</sup> space mid axillary line, dissection by Hilton method then insertion of ICT of large caliber and connected to under water seal.

This study was conducted in two groups with injection of streptokinase as follow; dose of Streptokinase (SK) given as (250,000 IU) for adults and 15000 IU/kg for pediatric patients diluted in 50 mL of saline solution followed by 50 mL saline through the intercostal tube with sterile injection. After that, the tube will be clamped for 1-2 hours with frequent postural change of the patients every 15 minutes then the clamp will be removed and the tube placed back on negative suction allowing the dissolved clots to be drained in the underwater seal. The amount of drain will be calculated daily. Chest X-ray to be done after the 2<sup>nd</sup> dose if there was residual of the clotted Hemothorax, a third dose given. This maneuver repeated for 2-3 successive days with recording the data in patient chart with chest x-ray finding and CT Chest. The chest tube removed when pleural drainage <50 mL serous fluid within 24h, lung fully expanded and no pleural effusion.

- ***Ethical consideration:*** An approval from Research Ethics Committee in Benha faculty of medicine had been already obtained

## Results

This study revealed that the mean period between trauma and SK use was higher in group B (13 days) than in group A (5 days) and this was statistically highly significant (P value <0.001). Also, it showed that the mean number of doses used in both groups was almost equal **as shown in table (1)** and this was insignificant statistical difference (P value = 0.14).

This study showed that the incidence of complicated clotted hemothorax was higher in group B (30%) than in group A (3.3%) **as shown in Fig (1)** and this was statistically significant difference (P value = 0.006).

This study showed that the failure of SK injection was higher in group B (63.3%) than in group A (23.3%) **as shown in table (2)** and this was statistically highly significant (P value = 0.002).

Also, this study showed that the total drainage after SK injection was higher in group B than in group A and this was statistically significant (P value =0.055). Also, it showed that the mean drainage of ICT in 1<sup>st</sup> day in group B (577) was higher than that of group A (543) **as shown in Fig (2)** and this was insignificant statistical difference (P value = 0.375).

This study showed that CT improving results post SK injection in group A were higher than that of group B which were statistically highly significant (P value = 0.001) and no improvement post SK injection was higher in group B than that of group A which was statistically highly significant (P value = 0.001) **as shown in table (3)**.

Also, this study showed that total hospital stay post SK injection in group B was higher than that of group A **as shown in Fig (3)** and there was statistically highly significant (P value < 0.001).

This study revealed that Decortication post SK injection in group B was higher than that of group A either by surgical thoracotomy or VATS **as shown in table (4)** and there was statistically highly significant (P value = 0.004).

**Table (1):** Distribution of the studied group regarding to period between trauma, Streptokinase use and number of doses used.

		<b>Group A (n = 30)</b>	<b>Group B (n = 30)</b>	<b>P value</b>	<b>Significant</b>
<b>Period between trauma &amp; SK use</b>	Mean ±SD	5 ±1	13 ±6	<0.001	HS
<b>Number of doses used</b>	Mean ±SD	3 ±1	3 ±1	0.14	NS

Independent t test was used.

(HS= highly significant, NS= non-

significant).

**Table (2):** Distribution of the studied group regarding to failure of streptokinase injection.

		<b>Group A</b> (n = 30)	<b>Group B</b> (n = 30)	<b>P value</b>	<b>Significant</b>
<b>Failure of SK</b>	Yes n (%)	7 (23.3)	19 (63.3)	0.002	HS

**Chi-square test was used.**

**(HS= highly significant)**

**Table (3):** Distribution of the studied group regarding to CT results post Streptokinase injection.

			<b>Group A</b> (n = 30)	<b>Group B</b> (n = 30)	<b>P value</b>	<b>Significant</b>
<b>CT post SK</b>	CR	n (%)	18 (60.0)	4 (13.3)	0.001	HS
	PR	n (%)	5 (16.7)	11 (36.7)		
	NR	n (%)	7 (23.3)	15 (50.0)		

Chi-square test was used. (HS= highly significant) (CT= computerized tomography)

(CR= complete response, PR= partial response, NR= no response)

**Table (4):** Distribution of the studied group regarding to surgical intervention post Streptokinase injection.

			<b>Group A</b> (n = 30)	<b>Group B</b> (n = 30)	<b>P</b> value	<b>Significant</b>
<b>Surgical intervention</b>	Decortication	n (%)	5 (16.7)	15 (50.0)	0.004	HS
	Thoracotomy	n (%)	4(13.3)	13 (43.3)	0.005	HS

	VATS	n (%)	1 (3.3)	2 (6.7)	0.15	NS
--	------	----------	---------	---------	------	----

**Chi-square or Fisher's exact test was used. (HS= highly significant, NS= non-significant, VATS= video assisted thoracoscopic surgery).**

## **Discussion**

Thommi G, et al. had reported that the effect of treatment with IPFT vary with in the 1<sup>st</sup> week and the 2<sup>nd</sup> week post traumatic hemothorax. In most cases in our study, treatment with intra pleural fibrinolytic therapy (IPFT) in the 1<sup>st</sup> week leads to complete resolution of radiographic abnormalities, through evacuation of blood clots and loculated effusion. <sup>(8)</sup>

Although, the use of IPFT generally causes no systemic coagulation effects, Tierney DM, et al. had reported that there was a single case of a major hemorrhage following intrapleural streptokinase instillation after 2 weeks post trauma attributed to systemic absorption of the agent with systemic side effects such as arthralgia, nausea, malaise, headache and fever, but this was against our study. <sup>(9)</sup>

Tomaselli F, et al had reported that there was highly significant difference in the total amount of ICT drainage and Period between trauma and SK injection. During the 2<sup>nd</sup> week post trauma there was larger amount of ICT drainage than that of 1<sup>st</sup> week post trauma and this was similar to our study. <sup>(10)</sup>

J Battistella FD and Benfield JR. had reported that post traumatic clotted hemothorax should be evacuated within a week after injury to avoid the complication of

fibrinopleuritis and empyema. Therefore, SK instillation in ICT is better to be given within 1<sup>st</sup> week than 2<sup>nd</sup> week and this was similar to our study. <sup>(11)</sup>

Kimbrell, B.J., et al. had reported the effectiveness of intra pleural streptokinase instillation during 1<sup>st</sup> week post traumatic clotted hemothorax and this played an important role in minimizing the needs to Decortication either by open thoracotomy or VATS and this was similar to our study. <sup>(12)</sup>

Oguzkaya F, et al. had reported there were highly statistically difference for length of hospital stay and number of thoracotomies when intra pleural streptokinase injected within one week or two weeks post trauma. For sure SK injection during 1<sup>st</sup> week post trauma had been given the excellent results and this was similar to our study. <sup>(13)</sup>

However, Smith J.W., et al reported that VATs was more effective and safe method in management of clotted hemothorax than IP SK injection especially after 2weeks post trauma and this was against of our study. <sup>(14)</sup>

## **Conclusions**

This study showed that intrapleural streptokinase injection could be an ideal option for post-traumatic clotted hemothorax before the decision is made to proceed to VATS or open surgical techniques especially when administered early in the 1<sup>st</sup> 7 days post trauma.

## **References**

- 1- **Morley EJ, Johnson S, Leibner E, Shahid J.** Emergency department evaluation and management of blunt chest and lung trauma. *Emerg Med pract*,2016;18(6):1-20
- 2- **Ota K, Fumimoto S, Lida R, Nakamura R, Inage Y, Tobita R, et al.** Massive hemothorax due to two bleeding sources with minor injury mechanism: a case report. *J Med case Rep*,2018;12(1):291
- 3- **Han GM, Newmyer A, Qu M.** seatbelt use to save money: impact on hospital costs occupants who are involved in motor vehicle crashes. *Int Emerg Nurs*.2017; 31:2-8.
- 4- **Carver DA, Bressan AK, Schieman C, Grondin SC, Kirkpatrick AW, Lall R, et al.** Management of hemothoraces in blunt thoracic trauma: study protocol for randomized controlled trial. *BMJ open*.2018;8(3):203-78
- 5- **DuBose J, Inaba K, Okoye O, Teixeira PG, Pepe A, Dunham MB, et al.** Development of posttraumatic empyema in patients with retained hemothorax: results of a prospective, observational AAST study. *J Trauma Acute Care Surg*. 2012; 73(3): 752-7.
- 6- **Soni NJ, Franko R, Velez MI, Schnobrich D, Dancel R, Restrepo MI, et al.** Ultrasound in diagnosis and management of pleural effusions. *J Hosp Med*.2015; 10(12):811-6.
- 7- **Chiumello D, Umbrello M, Sferrazza Papa GF, Angileri A, Gurgitano M, Formenti P, et al.** Global and Regional Diagnostic Accuracy of Lung

Ultrasound Compared to CT in Patients with Acute Respiratory Distress Syndrome. *Crit Care Med*, 2019; 47:1599.

- 8- **Thommi G, Nair CK, Aronow WS, Shehan C, Meyers P, McLeay M.** Efficacy and safety of intrapleural instillation of alteplase in the management of complicated pleural effusion or empyema. *Am J Ther* .2007; 14(4):341-345.
- 9- **Tierney DM, Huelster JS, Overgaard JD, Plunkett MB, Boland LL, St Hill CA, et al.** Comparative Performance of Pulmonary Ultrasound, Chest Radiograph, and CT Among Patients with Acute Respiratory Failure. *Crit Care Med* 2020; 48:151.
- 10- **Tomaselli F, Maier A, Renner H, Smolle-Ju'ttner FM.** Thoracoscopic water jet lavage in coagulated hemothorax, *Eur J Cardiothorac Surg*. 2003;23: 424-425.
- 11- **J Battistella FD, Benfield JR.** Blunt and penetrating injuries of the chest wall, pleura and lungs. In: Shields TW, LoCicero III, Ponn RB, editors, *General thoracic surgery*, 5th ed. Philadelphia, Lippincott Williams and Wilkins. 2000; 815-831.
- 12- **Kimbrell BJ, Yamzon J, Petrone P, Asensio JA, Velmahos GC.** Intrapleural thrombolysis for the management of undrained traumatic hemothorax: a prospective observational study. *J Trauma*. 2007; 62(5): 1175-8:1178-9.

- 13- Oguzkaya, F., Akcali Y, Bilgin M.** Video thoracoscopy versus intrapleural streptokinase for management of post traumatic retained hemothorax: a retrospective study of 65 cases. *Injury*. 2005; 36: 526-9.
- 14- Smith, J.W. Fong-Dee Huang, Wen-Bin Yeh, Sheng-Shih Chen, Yuan-Yuarn Liu, Yin Lu, et al.** Early VATS for blunt chest trauma: a management technique underutilized by acute care surgeons. *J Trauma*, 2011; 71(1): 102-5.