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Improvement of the puncture treatment methods of acute pleural empyema

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ABSTRACT

Application of the fixator of puncture needle in the treatment of acute non-specific pleural empyema of the chest by paracentetic method prevent the rise of involuntary movements forward - backward, up - down by using the fixator of a puncture needle on support plate. In our observations it allowed to avoid the development of complications and decrease the number of unfavorable results during the puncture treatment in the main group of patients.

Key words: acute empyema of the chest, puncture of the pleural cavity, fixator of a puncture needle.

INTRODUCTION

Thoracocentesis (pleural puncture) is an essential manipulation for diagnostics and treatment of pleural effusions. Puncture of the pleural cavity in the treatment of acute non-specific pleural empyema is used for evacuation of the pleural fluid and its further bacteriological and cytological examination, determination of negative intrapleural pressure, introduction of antibiotics and antiseptics [1, 2, 5].

According to the local and foreign authors, this method of acute pleural empyema treatment is effective for 94 - 96% of patients in the absence of pulmonary tissue destruction and bronchial fistula [3, 4].

The number of complications following pleural puncture is 2 (3.4%), the frequency of the transition of the disease into a chronic form occurs in 2% of patients, mortality is 0.8 % [2, 3, 5].

Thoracocentesis procedure (puncture of the pleural cavity) is widely described in medical literature. However, there are many risk factors associated with the appearance of anatomical changes of the chest skeleton after rib fractures, conduction of pleural puncture in supine position in critically-ill patients can lead to the development of complications (pneumothorax, intrapleural hemorrhage) even when it was executed by experienced professionals.

Doctor's involuntary (uncontrolled) movements (forward - backward, up - down) by a puncture needle are main causes of complications development. Another significant point is the distance between the inside of the chest wall and the surface of the lung in case of multilocular empyema. During repeated punctures the depth of the needle insertion may be insufficient and pleural puncture – ineffective due to the lack of information about the distance to the pus pocket [4, 5].

The objective of this work was the development and implementation into clinical practice the device allowing to reduce the number of complications during a puncture of a pleural cavity.

MATERIALS AND METHODS

We improved the puncture needle holder, consisting of support plate connected to the sleeve and the fixing screw (*Patent of invention* № 20158, 15.01. 2007, Bulletin №1). The fixator with a puncture needle is shown in Figure 1.

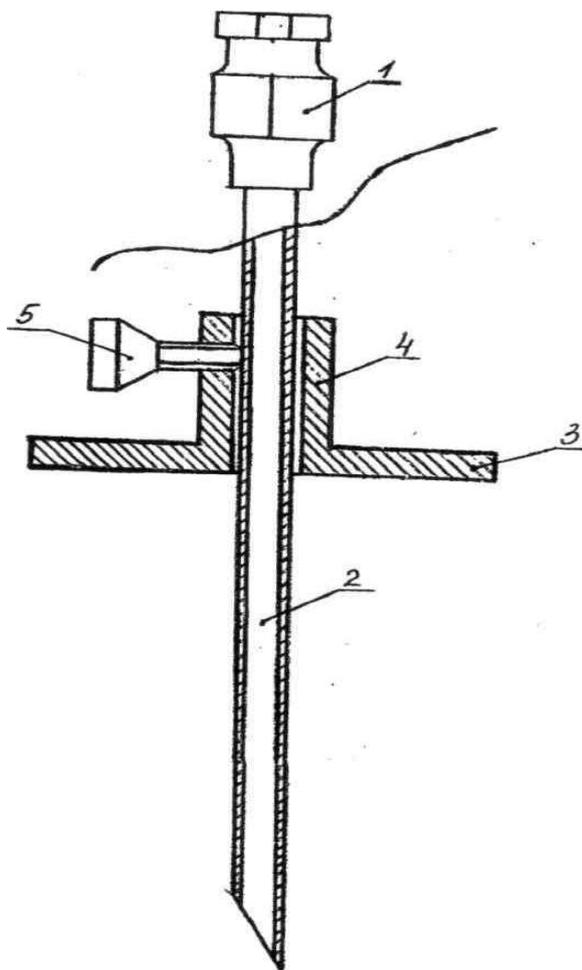


Fig. 1. Scheme of fixator with a needle

This device consists of the cannula 1, the hollow tube 2 with a sharp working end and the fixator, which is placed on the hollow tube 2. Fixator made in a form of support plate 3. The sleeve 4 and fixing screw 5 are connected to support plate 3 in such a manner that a hollow tube 2 is located in the sleeve 4 of the fixator and has capacity of longitudinal displacement.

The device operates as follows: a puncture needle is inserted into the sleeve 4 of the fixator then the fixator is advanced to the proximal part of the needle. Next the pleural puncture is performed. Insertion of the needle into the cavity is controlled by the change of the aspirated fluid, which gets through the needle into the syringe. After entering of the device's working end into the specified point, the position of the hollow tube 2 is fixed by moving the fixator and setting the support plate 3 on the surface of the chest and fixing the hollow tube 2 by the fixing screw 5. The device is ready for use. An evacuation is performed of the content of pleural cavity. Thereafter, the puncture needle is removed without changing the position of the fixator. The length of the fixator is 5 mm, which does not limit the depth of puncture.

The hollow structure of the sleeve permits to move fixator along the needle.

Puncture methods of treatment were used in 44 patients of the main group and in 52 patients of the control group with loculated or advanced pleural empyema. Fixator of the puncture needle was used for the pleural puncture of the main group of patients, while the pleural puncture of the control group patients was performed by the traditional method.

RESULTS AND DISCUSSION

The multiple X-ray views examination of the pleural cavity or ultrasound was performed. We determined the boundaries of the cavity and chose the most convenient point for the puncture.

Application of the fixator for pleural puncture allows to avoid involuntary movements by a puncture needle in all directions that reduces the risk of complications development. Prevention of involuntary movements such as forward

- backward and up - down is achieved by fixing the needle in the hollow tube of the support plate, as well as in the direction of its own axis due to the presence of the fixing screw.

Taking into account the possibility of the puncture needle withdrawing without changing the position of the fixator, it is possible to fix the length of the needle penetration_during repeated pleural punctures in patients with restricted localization of acute pleural empyema.

Application features of this device is shown in Figure 2, 3.



Fig. 2. Puncture of the right pleural cavity in a patient with right-sided acute parapneumonic pleural empyema. Fixator retracted to the proximal end of the needle.



Fig. 3. Retrieved discharge fluid from empyema cavity, the base plate is placed on the surface of the chest, the needle is fixed by the screw

The development of iatrogenic pneumothorax was observed in 52 patients of the control group. Besides, one patient (1.9%) had involuntary lung injury, which was complicated by a small hemothorax. In all of these cases, the cause of iatrogenic complications was involuntary movement of the needle due to the lack of its fixation. The pleural Bulau drain was performed for a patient with a pneumothorax. A patient with hemothorax received the puncture treatment. Ineffective puncture treatment was noted in 2 (3.8%) patients. Also it was noted the development of adhesions in the pleural space and chronic pleural empyema. Decortication of lung was performed in these patients.

Complications were not observed during pleural puncture among patients of the main group, despite the fact that 4 (9.09%) nonstandard punctures were performed: first 3 - 5 punctures were performed in the prone position in three patients due to the severity of their condition; one patient had a deformity of the chest, as a result of trauma.

The number of adverse outcomes of paracentetic treatment in the main study group was observed in one patient (2.27%) with acute left-sided interlobar pleural empyema. Subsequently, a thoracotomy and decortication of the lung was performed for this patient.

CONCLUSION

Thus, the use of the puncture needle fixator in the treatment of acute non-specific pleural empyema by the puncture method prevents the occurrence of involuntary movements such as: forward - backward and up - down; which is achieved by the needle fixation in the hole of the support plate. According to our observations, this allows to avoid complications development and reduce the number of adverse outcomes in the puncture treatment of the main group of patients, indicating a promising application of this technique in the treatment of acute pleural empyema.

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