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Role of chest ultrasound in detecting successful pleurodesis

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ABSTRACT

Background: Thoracic ultrasonography easily detects the sign of 'pleural sliding', due to the movement of the visceral pleura on the parietal pleura. This sign is absent when pleurodesis is successful.

Aim of work: This study was designed to detect the role of thoracic ultrasonography in the assessment of pleurodesis and compare between different sclerosing agents, mainly based on the presence or absence of the 'pleural sliding' sign.

Subject and methods: The study was conducted in Kasr El-Aini hospital, Cairo University in the period from April 2014 to April 2015. It was carried on 30 patients, 15 males and 15 females. The patients included in the study were classified into 4 groups according to cause of pleurodesis as follow spontaneous pleurodesis by the intercostal chest tube (group 1), pleurodesis with bleomycin (group 2), pleurodesis with doxycyclin (group 3) and pleurodesis with betadine (group 4). All patients were subjected for complete history taking and clinical examination, chest X-rays, chest CT, and thoracic ultrasound study before and after pleurodesis with assessment of sliding sign.

Results: The results of the study revealed that the ultrasound can easily detect sliding sign and assess the success of pleurodesis. Iodopovidone was more effective than bleomycin and doxycyclin in inducing pleurodesis in patients with malignant pleural effusion without statistically significant difference.

Conclusions: Thoracic ultrasonography for the evaluation of pleurodesis is feasible and simple. Iodopovidone was more effective than bleomycin and doxycyclin in inducing pleurodesis in patients with malignant pleural effusion.

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Introduction

Malignant pleural effusion (MPE) is defined as the presence of malignant cells in pleural fluid or pleural tissue. MPE is a common complication of advanced-stages of malignancies [1]. In most patients with MPE, palliative treatment requires pleurodesis with sclerosing agents. The most cost-effective method for controlling of MPE is drainage through thoracostomy tube and intrapleural instillation of a chemical agent including talc, tetracycline (e.g., doxycycline), bleomycin and povidone-iodine [2]. Sonographic criteria of a malignant effusion include diaphragmatic and parietal

pleura nodule or nodules, pleural thickening 1 cm or more and hepatic metastasis [3].

The aim of study

To detect successful pleurodesis in patients with malignant pleural effusion by using the chest ultrasonography and comparing between different sclerosing agents as regards to success rate.

Subjects and methods

A prospective study was conducted in Kasr El-Aini hospital, Cairo University in the period from April 2014 to April 2015. It was carried on 30 patients, 15 males and 15 females.

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Inclusion criteria: Any patient with malignant pleural effusion who underwent palliative treatment with insertion of intercostal tube.

Exclusion criteria: Loculated malignant pleural effusion.

All patients were subjected to the following:

1. Complete history taking and clinical examination.
2. Chest X-rays PA.
3. CT scan of the chest.
4. Medical thoracoscopy:
 - (A) **Equipment:** A rigid thoracoscope with a cold light source was used in most of the cases. Using KARL-STORZ rigid thoracoscopy.
 - (B) **Technique:** The vital signs of the patients were monitored (blood pressure, heart rate respiratory rate) during the procedure; also oxygen saturation was measured by pulse oximetry.
 - (C) **Premedications:** Atropin 1 mg IM injection was given to control vasovagal tone. Pethidine 100 mg (50 mg IM, 50 mg IV injection) to ensure proper control of pain and good analgesia.
 - (D) **Local anesthesia:** Lidocaine (xylocaine) 2%, was used for local anesthesia of the skin, subcutaneous tissue, muscles, peritoneum and parietal pleura.
 - (E) **Procedure:** The examination was performed with the patient lying on the healthy side. The incision is usually in the mid-axillary area between the third and sixth intercostal spaces. Choice of the point of entry varied depending on the site of dullness and guided by CT chest [4].

The single-entry technique for medical thoracoscopy was used in all cases.

The procedure includes the following phases:

- (a) Careful aspiration of pleural fluid in cases of pleural effusion.
 - (b) Dissection of adhesions preventing proper inspection of pleural space.
 - (c) Good inspection of pleural cavity using a direct-viewing telescope.
 - (d) Collection of multiple pleural biopsy, under direct vision. At the end of the procedure, a chest tube was inserted in place and connected to under water seal bottle. The chest tube was fixed to the skin of the patient at its exit from the chest wall by suture. Another suture (stay suture) was taken. Clear dressing was placed over chest tube [5].
 - (F) **Post-thoracoscopy assessment:** The patient was followed up in the inpatient unit for the following: Vital signs, Oxygen saturation by pulse oximetry, Chest tube drainage (air leak, fluid amount and color), Patients were given broad spectrum antibiotic and strong analgesia, Post procedure chest X-ray was done.
5. **Pathological examination:**
All the thoracoscopic pleural biopsies were sent for histopathological examination. The biopsy specimens were preserved in formalin containing cups and sent for histopathological examination where the specimens were stained with hematoxylin and eosin stains and examined under light microscopy. When the amount of fluid drained decrease to 100 ml or less per day, lung radiologically re-expanded against the chest wall by CXR and biopsies proved to be malignant transthoracic chest ultrasound is done to the patient.
6. **Transthoracic ultrasonography study:** (Hitachi 5500 in kaser El-Aini diagnostic ultrasound unit). All cases were examined by B-mode ultrasound with curvilinear transducer (3.5 MHz) to

assess the presence of the sliding sign before the injection of sclerosing agent. The patient sit with arms extended and resting on a firm surface that is just below the level of the shoulders. Raising the patient's ipsilateral arm up to or above their head widens the intercostal spaces and facilitates scanning.

All anatomical areas of the affected side of the lung were examined:

Anterior: infraclavicular, mammary, inframammary, upper axillary and lower axillary.

Back: suprascapular, interscapular and infrascapular.

Each area was given score according to sliding sign:

Sliding sign present 1

No sliding 0

There are two possibilities

- **The sliding sign was lost** denoting adherence of two pleura together so that there is no need to inject a sclerosant agent and the chest tube removed for follow up chest ultrasound after one month (spontaneous or tube induced pleurodesis) the score of the patient below the cutoff point 5. (**group1: 8 patients**).
- **The sliding sign present** (the score of the patient equal or more than 5) denoting good drainage of the effusion and the patient will need chemical pleurodesis as follow.

Procedure

- Injection of 20–40 ml of 2% lidocaine into the pleural space through the intercostal chest tube and injection of the sclerosing agent.

According to the type of the sclerosing agent, the patients were divided into three groups:

Group 2: Bleomycin is used to induce pleurodesis (**7 patients**) 4 vials of 15 U bleomycin dissolved in 40 ml of normal saline injected in the pleural space through the tube followed by 20 ml of normal saline to flush the chest tube.

Group 3: Doxycyclin (vibramycin) is used to induce pleurodesis (**8 patients**) 1 g of doxycyclin (vibramycin 100 mg) dissolved into 40 ml of normal saline injected in to the pleural space through the tube followed by 20 ml of normal saline to flush the chest tube.

Group 4: povidone-iodine is used to induce pleurodesis (**7 patients**) 20 ml of 10% povidone-iodine injected into the pleural space followed by 40 ml of normal saline to flush the tube.

- Intercostal tube is clamped for 1 to 2 h and the patient instructed to change his position in bed. The tube is then opened and left for 24 h to drain the injected amount of fluid then removed.
- Follow up transthoracic ultrasonography is done after one month to assess the success or the failure of the pleurodesis by using the sliding sign.

The statistical paragraph in material and methods

Data were statistically described in terms of mean \pm standard deviation (\pm SD), median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using Kruskal Wallis test. For comparing categorical data, Chi square (χ^2) test was performed. Exact test was used instead when the expected frequency is less than 5. *p* Values less than 0.05 was considered sta-

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