Ultrasound-assisted medical thoracoscopy

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Introduction Medical thoracoscopy is an important tool for the diagnosis and management of several pleural diseases. The presence of fibrous pleural adhesions may prevent medical thoracoscopy to access the pleural space properly, which may lower the diagnostic yield of the procedure and may also increase the risk for associated complications. The role of on-table chest ultrasound (US) before medical thoracoscopy is investigated in this study.

Aim of the study The aim of this study was to evaluate the utility of on-table chest US before medical thoracoscopy and its ability to locate a safe point of entry, its impact on the facility of the procedure, and the risk for complications.

Patients and methods Forty patients who underwent medical thoracoscopy for investigation of undiagnosed pleural effusion were included in this study. They were randomized into two groups. In group I, chest US was performed on table immediately before medical thoracoscopy and in group II, no chest US was performed.

Results Computed tomography chest detected pleural adhesions in one patient (5%) in group I and in two patients (10%) in group II, whereas medical thoracoscopy detected five patients (25%) in group II and six patients (30%) in group I. Chest US was able to detect all cases with pleural adhesions in group I. Four patients (20%) in group II needed extra procedures to access the pleural cavity due to unsuccessful primary point of entry, and two (10%) had complications in the form of bleeding. All patients in group I had successful access to the pleural cavity with no needed extra procedures and no complications. The mean duration of the procedure in group I was 42 ± 5.4 versus 50 ± 10.4 min in group II.

Conclusion Chest US performed before medical thoracoscopy can facilitate the procedure; it reduces the unsuccessful attempts to access the pleural cavity, minimizes the risk for complications, and reduces the duration of the procedure. *Egypt J Broncho* 2015 9:92–95

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Introduction

Medical thoracoscopy is now an established technique for diagnosis and management of various pleural disorders [1]. It is usually performed in the bronchoscopy suite under local anesthesia with conscious sedation but can be also performed in the operating theater under general anesthesia [2]. Medical thoracoscopy is undergoing further development with wider adoption of interventional procedures; it can be used in more advanced applications such as lung biopsy, empyema, and cervical sympathectomy [3].

Thick fibrous adhesions may impede a proper access and may prevent medical thoracoscopy from proper assessment of the pleural space [4].

Over the past few years, the use of chest ultrasound (US) has gained popularity; it is considered the fastest, noninvasive, sophisticated diagnostic tool used in the ICU and in other in-patient settings, free of complications and with minimal cost [5]. The value of ultrasonography for detection and quantification of pleural effusions is uncontested. In small effusions, US is more sensitive than decubitus expiratory films [6]. Sonographically, a pleural effusion manifests as an anechoic, homogeneous space between parietal and visceral pleura. Transudates are echo-free, unseptated, and free flowing. Exudates can exhibit specific patterns of echogenicity and fibrinous septations of various quality and density, which can serve as diagnostic clues. Echogenic swirling patterns have recently been linked to a malignant nature of an effusion [7]. US is better than computed tomography (CT) at demonstrating septae; however, the presence of septae does not imply loculations as the fluid may still be freely flowing within the hemithorax [8]. Chest US is known to facilitate thoracocentesis, and it has been proven that it increases the success rate and decreases the complications of this procedure [9]. The role of chest US performed immediately before medical thoracoscopy is evaluated in the present study.

Aim of the study

The aim of this study was to evaluate the utility of on-table chest US before medical thoracoscopy and its ability to locate a safe point of entry, its impact on the facility of the procedure, and the risk for complications.

Patients and methods

This prospective study was conducted at Ain Shams University Hospitals on 40 patients who underwent

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medical thoracoscopy for the investigation of undiagnosed pleural effusion. They were randomized into two groups. In group I, chest US was performed on table immediately before medical thoracoscopy and in group II, no chest US was performed.

All patients were subjected to thorough history taking, clinical examination, routine laboratory investigations, and CT scan of the chest without contrast.

Written informed consent was obtained from all patients, and ethical committe approval was obtained.

Medical thoracoscopy

In all patients, fasting for at least 6 h is required, with no other special preoperative preparation. The patients are monitored before and during the whole procedure (blood pressure, pulse, ECG, and pulse oximetry); the procedure was performed in lateral decubitus position with the affected side upward under general analgesia using a combination of inhalation anesthetic (isoflurane) and intravenous anesthetic (propofol). Skin sterilization was performed followed by incision and blunt dissection in the appropriate intercostal space to enter the pleural space. A 7-mm trocar was then inserted, and a 0° telescope was inserted through it and connected to a video camera; the pleural space was carefully inspected through the thoracoscope (Richard Wolf rigid thoracoscopy; Knittlingen, Germany). Abnormal (suspicious) areas were biopsied. The appearance of the parietal and visceral pleural surfaces and the extent of their involvement were assessed visually through the thoracoscope. Following the procedure, a chest tube was inserted and after recovery a control chest radiograph was performed.

Statistical analysis

Quantitative data were represented as mean ± SD, and qualitative data were represented as number and percentage. Data entry and statistical analysis were performed using SPSS for Windows, version 20.0 (SPSS Inc., Chicago, Illinois, USA).

Results

This study enrolled 40 patients with undiagnosed pleural effusion with a mean age of 57.77 ± 9.73 years; 28 patients were men (70%) and 12 were women (30%), and 40% of all patients were nonsmokers and 60% were smokers. History of occupational or residential exposure to asbestos was positive in 25% and negative in 75% of the patients. Demographic data of the included patients are displayed in Table 1.

The patients were randomized into two groups, 20 patients in each group. All patients underwent CT chest before the procedure. In group I, patients underwent chest US on table before medical thoracoscopy to identify the most appropriate point of entry, whereas in group II, no chest US was performed before medical thoracoscopy.

In group II, during medical thoracoscopy, six of 20 patients (30%) were found to have pleural adhesions, and CT chest was able to detect only two (10%) of them (Table 2). Of those patients, four (20%) needed extra procedures to access the pleural cavity due to unsuccessful primary point of entry, and two (10%) had complications in the form of bleeding.

In group I, during medical thoracoscopy, six patients (30%) were found to have pleural adhesions; CT chest was able to detect only one of those patients (5%) (Table 2), whereas chest US was able to recognize all patients (30%) with pleural adhesions (Table 3). A statistically significant difference was found between chest US and CT chest in detection of pleural adhesions (P = 0.0374) (P < 0.05) (Table 4). All patients in group I had successful access to the pleural cavity with no needed extra procedures and no complications.

The comparison between both groups shows no difference in the prevalence of pleural adhesions. However, it shows

Table 1 Demographic characteristics of the studied group

Characteristics	*n* (%)
Age (years)	
Mean ± SD	57.77 ± 9.73
Range	32–72
Sex	
Male	28 (70)
Female	12 (30)
History of occupational or residential exposure to asbestos	
Positive	10 (25)
Negative	30 (75)
Smoking	
Smoker	24 (60)
Nonsmoker	16 (40)

Table 2 Comparison between computed tomography chest and medical thoracoscopy in detection of pleural adhesions in both groups

Pleural adhesions	Pleural adhesions [*n* (%)]	
	CT chest	Medical thoracoscopy
Group I (20 patients)	1 (5)	6 (30)
Group II (20 patients)	2 (10)	6 (30)

CT, computed tomography

Table 3 Comparison between chest ultrasound and medical thoracoscopy in detection of pleural adhesions in group I patients

Pleural adhesions	Pleural adhesions [*n* (%)]	
	Chest ultrasound	Medical thoracoscopy
Group I (20 patients)	6 (30)	6 (30)

statistically significant difference with respect to the successful access to the pleural space and the need for extra procedures ($P = 0.0350$) ($P < 0.05$) (Table 5). The mean duration of the procedure for group I was 42 ± 5.4 min, whereas it was 50 ± 10.4 min in group II. There was a statistically significant difference between the two groups with respect to the length of the procedure ($P = 0.004$) ($P < 0.05$) (Table 6). There was no statistically significant difference between the two groups with respect to the occurrence of complications (Table 7).

Discussion

Undiagnosed pleural exudates are commonly seen in the practice of pulmonary medicine. Medical thoracoscopy is an easy and usually safe technique; it is considered the gold standard in the diagnosis of unexplained pleural effusion [1]. Pleural adhesions represent a problem confronting operators at medical thoracoscopy; these adhesions are not always detected by CT chest, and it is better visualized by thoracic US [10].

This study evaluates the utility of portable chest US immediately before medical thoracoscopy and its ability to facilitate the procedure and to minimize the risk for complications.

Table 4 Comparison between chest ultrasound and computed tomography chest in detection of pleural adhesions in group I patients

Pleural adhesions	Pleural adhesions [*n* (%)]	
	Chest ultrasound	CT chest
Group I (20 patients)	6 (30)	1 (5)

CT, computed tomography, *$P < 0.05$.

Table 5 Comparison between group I and group II with respect to successful pleural cavity access and need for extra procedures

Successful access and extra procedures	Group I (20 patients)	Group II (20 patients)
Successful pleural cavity access [n (%)]	20 (100)	16 (80)
Need for extra procedures to access the pleural cavity [n (%)]	0	4 (20)

*$P < 0.05$.

Table 6 Comparison between group I and group II with respect to the length of the procedure

Length of the procedure	Group I (20 patients)	Group II (20 patients)
Mean length of the procedure (min)	42 ± 5.4	50 ± 10.4

*$P < 0.05$.

Table 7 Comparison between group I and group II with respect to occurrence of complications

Complications	Group I (20 patients)	Group II (20 patients)
Occurrence of complications [n (%)]	0	2 (10)

The results of our study showed a significant reduction in unsuccessful pleural access and the need for extra procedures from 20% in group II (the non-US group) to 0% in group I (the US group) ($P < 0.05$), knowing that there was no difference in the prevalence of pleural adhesions between the two groups. These results are in accordance with the study by Andrew and colleagues, who found that there was a strong trend in reduction of pleural access failure rates from 16.7 to 0% ($P = 0.0522$). The prevalence of fibrous septations reported in their study was 26.7%, which is quite similar to that in our study (27.5%) [11]. Another prospective study on 20 patients in a tertiary center used transthoracic US before medical thoracoscopy in the presence of fibrous adhesions; the pleural access was successful in 100% of cases, which is consistent with our findings [4]. The prevalence of thick fibrous adhesions reported in the study (15%) was slightly less than that in our study (27.5%). The study of Macha *et al.* [12], another uncontrolled study that used chest US premedical thoracoscopy, showed a 100% pleural access rate and the prevalence of thick fibrous adhesions in their study was 22% compared with 27.5% in our study.

The rate of failed pleural access in group II in our study was 20%, which is comparable with the study by Andrew *et al.* (16.7%) [11] but is definitely higher than that in other published studies in which it ranged from 4 to 12% [13–15].

We also found that there was a significant difference in the length of the procedure; the mean duration for group I was 42 ± 5.4 versus 50 ± 10.4 min for group II ($P < 0.05$).

The results demonstrated that two patients in group II had complications in the form of bleeding during the procedure, which was basically due cutting some of the vascular adhesions that could not be avoided due to inappropriate trocar position. Group I showed no complications in any patient.

On the basis of the results of this study, whenever chest US is available, we recommend its use before medical thoracoscopy, as a complementary tool with CT chest, to better assess the pleural space, making the procedure easier and safer.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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