Evaluation of rapid pleurodesis technique in patients with malignant pleural effusion

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Background The objective of this study is to see whether a rapid method of pleurodesis is superior to the standard protocol in patients with symptomatic malignant pleural effusion.

Patients and methods This is a prospective, randomized control study that was held in Ain-Shams University Hospitals and included 30 patients diagnosed with malignant pleural effusion. Thirty patients who had been diagnosed with malignant pleural effusion histologically and/or cytologically were assessed and they were divided into two groups. Group A: 10 patients submitted to the standard pleurodesis technique using 24 or 28 F thoracotomy tube. Group B: 20 patients submitted to the rapid pleurodesis technique using pigtail (12 F). Pleurodesis was done by vibramycin and follow up of the patients was done with chest radiography at 1, 3, and 6 months after pleurodesis.

Results There was no statistically significant difference in the demographic features, site of the primary tumor, disease characteristics, and response rates in any evaluation period in both groups. However, the number of days of drainage and hospitalization were significantly lower in the second group.

Conclusion This new pleurodesis method provided a shorter hospital stay resulting in superior cost-effectiveness and palliation without sacrificing the efficacy of pleurodesis.

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Introduction

Malignant pleural effusions are challenging as regards its diagnostic and therapeutic goals [1].

Chest pain and dyspnea remain major clinical presentations and are associated with great morbidity and unpleasant quality of life. Malignant pleural effusions may continue or reappear regardless of radiotherapy and chemotherapy; in such cases certain procedures such as thoracentesis and tube thoracotomy are expected to improve patients' symptoms [2,3].

Closing the potential pleural cavity by pleurodesis with sclerosing materials such as an asbestos-free talc is very efficient for recurrent malignant pleural effusion; however, it needs hospitalization and tube thoracotomy [4].

Effective pleurodesis is associated mainly with drainage duration and caliber of the chest tube [5].

The palliative interventional treatment of malignant pleural effusions to relieve shortness of breath should be achieved with noticing the hospital admission period and chest tube drainage time as those patients are immunocompromised. Nevertheless, tube thoracotomy should be removed with subsequent pleurodesis if tube daily drainage is less than 200–400 ml with the inflated lung. However this method requires prolonged hospitalization with decreased percentage of efficient pleurodesis. Consequently, rapid pleurodesis by doxycycline in recurrent pleural effusions may decrease the hospital stay and increased the success of pleurodesis [6].

Aim of the work

To assess the efficiency of the rapid pleurodesis technique in malignant pleural effusion in comparison to the standard technique.

Patients and methods

This is a prospective, experimental, randomized control study that was held in Ain-Shams University Hospitals during the period from July 2016 to July 2017 and included 30 patients diagnosed with malignant pleural effusion. This manuscript was extracted from thesis of master degree, as any research was judged by ethical committee of chest department and when approved it was referred to ethical committee of the faculty of medicine. But we don't have an ethical approval statement as it's regulation of the faculty. Criteria for consideration such as a candidate for pleurodesis in patients with malignant pleural effusions were as follows: (a)

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anticipated survival longer than 1 month after performance of pleurodesis, (b) improved respiratory symptoms after a previous therapeutic thoracentesis, (c) cytological or histological confirmation of the malignant pleural effusion, and (d) ability to re-expand fully the lung during drainage of pleural fluid by tube thoracotomy.

Thirty patients who had been diagnosed with malignant pleural effusion histologically and/or cytologically were assessed and they were divided into two groups:

Group A: 10 patients submitted to standard pleurodesis technique using 24 or 28 F thoracotomy tube (Medline Industries Inc., Los Angeles, USA).
Group B: 20 patients submitted to rapid pleurodesis technique using pigtail 12 F (McKesson Medical-Surgical Inc., Texas, Irving, USA).

Pleurodesis was done by vibramycin (10 capsules of vibramycin 100 mg/capsule) [7] and mixed in 50 ml normal saline under sterile conditions. Before injecting this sclerosing material intrapleurally, 5 ml of lidocaine 2% was injected to minimize pain sensation. Informed consent was obtained from all patients before their participation in the study. Follow up of the patients was done with chest radiography (CXR) at 1, 3, and 6 months (if the patient was alive) after pleurodesis.

Patients in group A had continued thoracotomy tube evacuation of pleural fluid till less than 150 ml/24 h, followed by vibramycin instillation; removal of the tube was decided when the volume of drained pleural fluid of less than 150 ml/24 h after vibramycin instillation.

Patients in group B had pigtail catheter drainage; pleural fluid was withdrawn every 6 h till negative suction was reached. Pigtail catheter was removed after vibramycin instillation with pleural fluid drainage of less than 150 ml/last three aspirations.

After pleurodesis CXR was done at 1, 3, and 6 months after pleurodesis. Patients were graded according to their pleurodesis response to:

(1) Complete (no radiological pleural fluid reaccumulation or clinical presentation).
(2) Partial (CXR shows small amounts of pleural fluid recurrence, but no symptoms).
(3) Failure (pleural fluid recurrence requiring pleural aspiration with clinical manifestations).

Statistical analysis

The t test for independent samples was used for continuous variables and the χ^2 tests for comparison of proportions at each group.

The two management techniques were compared at each step (1, 3, and 6 months) using the χ^2 test.

All statistical comparisons between the two groups were carried out at a significance level of P value less than 0.05 which was considered a statistically significant result. A P value less than 0.01 was considered a highly statistically significant result.

Results

Thirty patients (16 men, 14 women) with malignant pleural effusion were enrolled in the present study and

Table 1 Demographic characteristics of group A (patients submitted to standard pleurodesis technique)

Group A	*N*=10
Age	
Mean±SD	56.90±8.60
Range	45–75
Sex [*n* (%)]	
Females	7 (70.0)
Males	3 (30.0)
Comorbidities [*n* (%)]	
DM	8 (80.0)
HTN	6 (60.0)
ISHD	0 (0.0)
Smoking	3 (30.0)
Smoking index	
Mean±SD	30.00±10.00
Range	20–40
Site of effusion [*n* (%)]	
Right	6 (60.0)
Left	3 (30.0)
Bilateral	1 (10.0)
Size of effusion [*n* (%)]	
Moderate	8 (80.0)
Massive	2 (20.0)
Treatment [*n* (%)]	
Chemotherapy	3 (30.0)
Radiotherapy	3 (30.0)
Hormonal	3 (30.0)
Malignancy [*n* (%)]	
Biphasic mesothelioma	1 (10.0)
Epithelial mesothelioma	1 (10.0)
Large-cell carcinoma	1 (10.0)
Malignant epithelial cell	0 (0.0)
Metastatic adenocarcinoma	5 (50.0)
Metastatic breast carcinoma	2 (20.0)
Metastatic large-cell carcinoma	0 (0.0)
Non-Hodgkin's lymphoma	0 (0.0)
Small cell	0 (0.0)

DM, diabetes mellitus, HTN, hypertension, ISHD, ischaemic heart disease.

were divided into: group A which consists of 10 patients, submitted to standard pleurodesis technique. Group B consists of 20 patients who were submitted to rapid pleurodesis technique.

Tables 1 and 2 show the demographic data of the studied patients (30 patients), predominant comorbidities, smoking index, site, and size of pleural effusion, treatment received, and predominant malignancies.

There is a nonsignificant statistical difference between both groups as regards age, sex, and total amount of drained pleural fluid as shown in Tables 3 and 4.

There is a significant statistical difference between both groups as regards the number of days of drainage and days of hospitalization as shown in Tables 5 and 6.

There is a nonsignificant statistical difference between both groups as regards the success of pleurodesis after 1, 3, and 6 months' evaluation (complete response, partial response, and failure of pleurodesis) as shown in Table 7.

Table 2 Demographic characteristics of group B (patients submitted to rapid pleurodesis technique)

Group B	*N*=20
Age	
Mean±SD	6l.00±10.73
Range	42–83
Sex [*n* (%)]	
Females	8 (40.0)
Males	12 (60.0)
Comorbidities [*n* (%)]	
DM	10 (50.0)
HTN	13 (65.0)
ISHD	3 (15.0)
Smoking	10 (50.0)
Smoking index	
Mean±SD	25.00±9.72
Range	10–40
Site of effusion [*n* (%)]	
Right	12 (60.0)
Left	8 (40.0)
Bilateral	0 (0.0)
Size of effusion [*n* (%)]	
Moderate	11 (55.0)
Massive	9 (45.0)
Treatment [*n* (%)]	
Chemotherapy	8 (40.0)
Radiotherapy	8 (40.0)
Hormonal	4 (20.0)
Malignancy [*n* (%)]	
Biphasic mesothelioma	1 (5.0)
Epithelial mesothelioma	6 (30.0)
Large-cell carcinoma	1 (5.0)
Malignant epithelial cell	1 (5.0)
Metastatic adenocarcinoma	4 (20.0)
Metastatic breast carcinoma	4 (20.0)
Metastatic large-cell carcinoma	1 (5.0)
Non-Hodgkin's lymphoma	1 (5.0)
Small cell	1 (5.0)

DM, diabetes mellitus, HTN, hypertension, ISHD, ischaemic heart disease.

Discussion

High morbidity is related to malignant pleural effusion, so the main core for patients' clinical alleviation is effective

Table 4 Total drainage of the pleural fluid in groups A and B

	Group A (*N*=10)	Group B (*N*=20)	Test value	*P* value	Significance
Total drainage	3300 ±3700	3050 ±1200	0.278	0.783	NS

NS, nonsignificant.

Table 5 Correlation between groups A and B according to the days of drainage

	Group A (*N*=10)	Group B (*N*=20)	Test value	*P* value	Significance
Days of drainage	8±3	3±1.5	6.141	<0.001*	HS

HS, highly significant. *stand for highly significant.

Table 6 Comparison between groups A and B according to the days of hospitalization

	Group A (*N*=10)	Group B (*N*=20)	Test value	*P* value	Significance
Days of hospitalization	9±4	4±2	4.606	<0.001*	HS

HS, highly significant. *stand for highly significant.

Table 3 Age and sex for group A and group B

	Group A (*N*=10)	Group B (*N*=20)	Test value	*P* value	Significance
Age					
Mean±SD	56.90±8.60	61.00±10.73	–1.049	0.303	NS
Range	45–75	42–83			
Sex [*n* (%)]					
Females	7 (70.0)	8 (40.0)	2.400	0.121	NS
Males	3 (30.0)	12 (60.0)			

NS, nonsignificant.

Table 7 The response to pleurodesis in groups A and B after 1, 3, and 6 months' evaluation

	Group A [*n* (%)]	Group B [*n* (%)]	Test value	*P* value	Significance
1-month evaluation					
CR	4 (40.0)	6 (30.0)	0.718	0.869	NS
PR	4 (40.0)	10 (50.0)			
Failure	1 (10.0)	3 (15.0)			
NA	1 (10.0)	1 (5.0)			
3-month evaluation					
CR	3 (30.0)	6 (30.0)	0.138	0.987	NS
PR	4 (40.0)	9 (45.0)			
Failure	2 (20.0)	3 (15.0)			
NA	1 (10.0)	2 (10.0)			
6-month evaluation					
CR	2 (20.0)	6 (30.0)	0.629	0.890	NS
PR	5 (50.0)	8 (40.0)			
Failure	1 (10.0)	3 (15.0)			
NA	2 (20.0)	3 (15.0)			

CR, complete response; failure, failure of pleurodesis; NA, not available (loss of the subject); NS, nonsignificant; PR, partial response.

pleurodesis of the inflated lung. The use of rapid pleurodesis technique is rising primarily for patients with malignant pleural effusion with decreased survival rates due to variable treatment response [8].

Among other goals of management, improving the quality of a patients' life is of utmost importance. A decrease in hospital stay and early removal of tubes are considered a constituent part of the quality of life. In the last couple of decades, these factors have been the focal points of clinicians in helping progress in the management of malignant pleural effusion [9].

Subsequent studies by Patz *et al*. [10], Hsu *et al*. [11], and Marom *et al*. [12] suggested the usage of pigtail for evacuation and pleurodesis as a comparable alternative to previously used large-bore chest tubes.

The aim of this study is to assess the efficiency of rapid pleurodesis technique in malignant pleural effusion in comparison to standard technique.

The results of the present study showed that there is a nonsignificant statistical difference between both groups as regards the demographic data (age and sex) which coincided with the findings of Yildirim *et al*. [13], who stated that there is no statistically significant difference between the two groups as regards demographic features, site of the primary tumor, and disease characteristics.

The present study showed that the number of days for pleural effusion drainage in group B (pigtail insertion) were shorter than group A and this matched with the results of Yildirim *et al*. [13], Spiegler *et al*. [14], and Porcel *et al*. [15].

Moreover, research work performed by Bediwy and Amer [16] evaluated the use of small-bore pigtail catheter in comparison with chest tube thoracostomy They stated that the former technique is a less invasive, efficient one for draining pleural effusions and requires less hospital stay which is in accordance with our results. The results of our study show the effective response of rapid pleurodesis technique after 6 months' evaluation which is in accordance with the results of Hsu *et al*. [11], Spiegler *et al*. [14], Porcel *et al*. [15], and Musani *et al*. [17] who assessed rapid pleurodesis technique in which they did not wait for the drain output to decrease, and carried out pleurodesis within 1–2 days of the catheter tube insertion with very promising results and high overall success rate of pleurodesis.

Interestingly, the use of rapid pleurodesis technique is of particular importance, especially in developing countries as the burden of health care is decreased with cost-effective solutions such as pigtail insertion with rapid pleurodesis. A cost-effective solution, such as this strategy, would allow more patients in our setup to gain access to palliation in more easier ways in case of malignant pleural effusion.

Our study has several limitations: the small number of studied patients, not comparing the different types of malignancies, and not considering the preexisting comorbidities as having a crucial impact on the success or failure of pleurodesis.

Conclusion

In conclusion, rapid pleurodesis technique can offer good results in comparison to the standard pleurodesis technique as regards the duration of hospitalization,

rapidly re-accumulating pleural effusion, and infection control. Also, it is a less invasive technique, safer, and is more tolerated by patients.

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Conflicts of interest
There are no conflicts of interest.

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