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Article Name 3- **Evaluation of Routine Thoracentesis in Changing the First Diagnosis and Care of Clinically Definite Pleural Effusion in a Medical Intensive Care Unit**

Authors Amin Ehteshami Afshar, Haleh Mikaiili, Roozbeh Naghshin, Mohammad Mehdi Zahmatkesh

Authors Specialization Department of Pulmonary Medicine, Iran University of Medical Sciences and Health Services, TEHRAN-IRAN

Introduction

Pleural complications in the medical intensive care unit (MICU) are common. They are rarely a manifestation of primary pleural disease and mostly Correspondence to: Mikaiili H Tel.: +98-21-6515001 Fax: +98-21-6517118 E-mail address:mikaiili@yahoo.com reflect a pulmonary or extrapulmonary disorder (1). The MICU admitted patients are usually in high-risk conditions and require prompt diagnosis and therapy. Pleural effusion is one of the most common complications observed in these patients and correct diagnosis and therapy of pleural effusions will assist in improving pulmonary physiology and outcome in the MICU patients. However, few studies have evaluated the incidence and etiologies of pleural effusions in MICU patients. According to the study of Mattison et al., the prevalence of pleural effusions in 100 consecutive MICU patients was 62%, with 41% of effusions detected at admission. The value of daily portable chest radiographs in ICUs is controversial. The image obtained from portable chest radiographs is technically inferior to the standard postero-anterior chest radiograph. This is secondary to the shorter distance between the patient and the source of the X-ray beam, which results in magnification of the cardiac silhouette and blurring of thoracic shadows. Some subjects did not have chest ultrasound because of hemodynamic instability or refusal to undergo the procedure. Sonograms in these patients had to be performed while the patients were in supine position due to their severe underlying disease. Small effusions (100 ml) may not be detectable on supine chest sonograms but can be documented on CT (2). Repeated evaluations with CT and CXR resulted in time wastage and also in some cases did not confirm a definite diagnosis before patients death (2-4). Thus a rapid and more reliable method in this condition is an important point for MICU team. In a prospective study of MICU patients with physical and radiographic evidence of pleural effusion, we performed routine thoracentesis to evaluate the contribution of this procedure in changing the first diagnosis and treatment.

Thirty patients admitted to Hazrate Rasool- e-Akram Hospital MICUs from July 2002 to August 2003 were screened prospectively for physical and radioghraphic evidences of pleural effusion. Exclusion

Material & Method

criteria were: 1. hemodynamic unstability (blood pressure < 90/ 60 mmHg). 2. Severe respiratory insufficiency (PaO2<50 mmHg). 3. Small effusion that could not be detected by physical examination and could not be tapped under sonographic guide. 4. Severe hemostatic abnormalities (platelet< 5000 / lit and PT>5 control unit). On the first day of admission, the selected patients went under accurate clinical examination and various paraclinical tests. Also, vital signs and clinical data on the day of thoracentesis (temperature, ankle edema, cardiogenic-pulmonary edema, need for mechanical ventilation, vasopressors and diuretics) were considered. Other variables that are characteristics of the effusion are being unilateral or bilateral, the average time from admission to thoracentesis day, appearance and laboratory findings of pleural effusion (protein, albumin, glucose, and lactate dehydrogenase [LDH] levels; WBC count and proportion of neutrophils; and microbiological findings for bacteria and mycobacterium tuberculosis), and simultaneous results of blood test on the day of thoracentesis (protein, albumin, LDH, glucose and leukocyte count). Pleural effusion was diagnosed based on physical examination whenever possible: reduced or absent breath sounds at auscultation, flatness to percussion, and reduction of tactile fremitus. Confirmation of the effusion was sought routinely on a chest radiograph obtained daily or at least 48 hours in patients under mechanical ventilation. The size of the effusion was classified as suggested by Fartoukh and colleagues to very small, small, moderate, and large (1). The cause of pleural effusion was determined based on the radiographic findings before thoracentesis (presumptive diagnosis) and when a pleural effusion was detected, thoracentesis was performed and diagnosis was based on the results of thoracentesis (definite diagnosis). Transudative and exudative effusions were defined by the criteria of Light et al. (5). Based on these criteria three pleural effusion categories were defined which are as follows: 1- Transudative effusion 2- Infectious exudative effusion 3- Noninfectious exudative effusion. Diagnoses were classified as follows: heart failure, hypoalbuminemia, parapneumonic effusion, empyema, malignancy, hemothorax, postoperative effusion, pancreatic effusions, and pulmonary emboli. All diagnoses were based on physical examination, laboratory tests, and history. Treatment plan was based on presumptive diagnosis and then all treatment changes according to results of thoracentesis were recorded. Statistical analysis: Comparisons between groups were analyzed by the X2 test for qualitative variables and by the t-test for quantitative variables. Thoracentesis was performed to evaluate both the diagnosis and the treatment changes. Correlation between glucose, protein, and WBC of blood and effusion was analyzed by ?A? Pearson regression coefficient?A?.

From the 30 patients with definite pleural effusion that underwent this study, there were 12(40%) male and 18(60%) female with the mean age of 65.6A?b17.8 years. Two patients (6.7%) were diabetics, 7 patients (23.3%) had documented heart failure, 3 patients (10%) had chronic renal failure, 7 patients (23.3%) had chronic obstructive pulmonary disease (COPD), 3 patients (10%) had hypertension, one patient (3.3%) was neutropenic, 2 patients were under chemotherapy, 5 patients (16.7%) had malignancy, and 12 patients (40%) had other causes.The most common cause of the MICU admission was hypoxic respiratory failure (21 patient, 70%). Other causes were acute on chronic respiratory failure (ACRF) in 6 patients (20%), shock in 2 patients (6.7%), acute renal failure in 6 patients

Result

(20%), coma in one patient (3.3%), pulmonary emboli in 2 patients (6.7%), stroke in one patient and (3.3%), and other causes in 8 patients (26.7%) (table1).

Vital signs and clinical conditions on the day of performing thoracentesis were fever in 19 patients (63.3%), pedal edema in 16 patients (53.3%), cardiogenic pulmonary edema in 3 patients (10%), clinically confirmed infection in 15 patients (50%), and in 6 patients (20%) microbiologically confirmed infection. Eighteen patients (60%) were receiving mechanical ventilatory support (need for PEEPA?d5cm H2O in 17 cases). In 4 cases (13.3%), there was the need for vasopressor agents. Time from MICU admission to thoracentesis were as follows: in 19 patients (63.3%) this duration ranged from 1 to 5 days, in 6 patients (20%) 6 to 10 days, and in 5 patients (16.7%) it was more than 10 days. Also 24 patients (80%) were taking antibiotics, and 5of them (16.7%) were on diuretics. Table 2 shows summary of these characteristics.

Fluid was obtained in all cases. The fluid was clear in 16 patients (53.3%), bloody in 3 patients (10%), hemorrhagic in 5 patients (16.7%), cloudy in 6 patients (20%), serosanginous in 4 patients (13.3%), and turbid in 1 patient (3.3%). The obtained effusion was transudate in 19 patients (63.3%), a noninfectious exudate in 7 patients (23.3%), and infectious exudate in 4 patients (13.3%). Transudates were attributable to pulmonary emboli in 6 patients (31.6%), hypoalbuminemia in 5 patients (26.3%), congestive heart failure and volume overload in 6 patients (31.6%), and lung collapse in 2 cases (10.5%). From 4 patients with infectious exudative effusion, 3 patients (75%) had a parapneumonic effusion and the last one had empyema. Causes of the noninfectious exudate were malignant effusion in 3patients (42.9%), parapneumonic effusion in 2 patients (28.6%) pulmonary embolism in one case and empyema in one case. The amount of effusion in 21 patients (70%) was moderate. Other thoracentesis findings are detailed in table 3.

There were no significant differences in mortality or ICU duration of stay between above three groups. No significant differences were found among the three-pleural effusion groups for age, sex, blood leukocytosis, or the need for mechanical ventilation at the time of thoracentesis. Effects of thoracentesis in changing the ?A? presumptive diagnosis?A? and first treatment plan were: Overall, there were significant differences between the diagnosis before and after thoracentesis in 17 patients 56.7% ($p<0.05$). In 13 patients (43.3%), definite diagnosis after thoracentesis was the same as initial diagnosis. Also, 16 patients (53.3%) received a change in their treatment plan based on thoracentesis findings ($p<0.05$). These findings (table 4) showed a significant and marked improvement in the diagnosis and management of pleural effusion after thoracentesis (Figure 1).

Few patients are admitted to the MICU because of pleural effusion, and there are usually other reasons for their admission. Mattison et al. reported the most common cause of pleural effusion in their MICU, which was heart failure in a frequency of 62% (2). In Fartoukh study this cause was an infective process (1). In other study made by Strange C, the most common causes were heart failure and pneumonia (7). This study showed that in our MICU, pulmonary

Discussion

emboli, parapneumonic and heart failure were the most frequent causes of pleural effusions. Although thoracentesis has been reported to be safe, even in patients receiving mechanical ventilation (7,8,9) few studies have focused on its feasibility and clinical implications in MICU patients. Thoracentesis resulted in a change in diagnosis and/or treatment in as many as 50% of our patients. The highest change was in the case of parapneumonic effusions; in 16 patients (53%) with presumptive diagnosis of parapneumonic, thoracentesis were resulted to this diagnosis only in 5 patients (16.7%). In contrast volume overload and pulmonary emboli were underdiagnosed before thoracentesis and must be considered in all suspected cases. It is obvious that improvement in diagnostic and therapeutic strategies results in better quality of care. For example, in 4 patients with transudative effusion, their presumptive diagnosis was parapneumonic effusion. In view of the results of their thoracentesis and the presence of hypoxic respiratory failure, we decided to perform ventilation/ perfusion scan study of lungs. This resulted in diagnosis of pulmonary embolism. Other diagnostic tools such as ultrasound or CT can detect small effusions, but the clinical significance of these remains unclear. Moreover, published guidelines do not recommend thoracentesis in patients known to have left-heart dysfunction associated with pleural effusion unless the patient is febrile and/or unilateral and/or associated with chest pain (5). In MICU patients, this restriction on performing thoracentesis in patients with known heart failure may result in overestimation of transudates related to heart failure and, consequently, in misdiagnosis of effusions due to other causes. Our study confirmed this important point. Diagnosing infectious effusions is important in order to improve the treatment and prognosis. In our study, routine thoracentesis provided the correct diagnosis of pleural empyema in 2 patients for which the presumptive cause was not the same. This shows that commonly used parameters, including body temperature and leukocytosis, may fail to indicate empyema, leaving routine thoracentesis as a very useful diagnostic study. In comparison with those who did not undergo thoracentesis, we did not observe any significant complication in our studied patients, even in mechanically ventilated cases. As previously reported in ICU patients, routine thoracentesis was safe (10,11).

Refrences

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Conclusion

According to our study, thoracentesis improves diagnosis and treatment. We recommend that thoracentesis should be performed routinely in MICU patients with a pleural effusion. This safe and cheap procedure may provide large gains in diagnosis, treatment, and even in prognosis.

Images of Article

table 1.JPG , table 2.JPG , table 3.JPG , table 4.JPG , figure 1.JPG