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ORIGINAL ARTICLE

Factors influencing pleural drainage in parapneumonic effusions

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KEYWORDS
Empyema;
Parapneumonic effusion;
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Abstract
Objective: The identification of parapneumonic effusions (PPE) requiring pleural drainage is challenging. We aimed to determine the diagnostic accuracy of radiological and pleural fluid findings in discriminating between PPE that need drainage (complicated PPE (CPPE)) and those that could be resolved with antibiotics only (uncomplicated PPE (UPPE)).
Subjects and methods: A retrospective review of 641 consecutive PPE, of which 393 were categorized as CPPE and 248 as UPPE. Demographics, radiological (size and laterality on a chest radiograph) and pleural fluid parameters (pus, bacterial cultures, biochemistries) were compared among groups. Logistic regression was performed to determine variables useful for predicting chest drainage, and receiver-operating characteristic curves assisted in the selection of the best cutoff values.
Results: According to the likelihood ratios (LR), findings increasing the probability of chest tube usage the most were: effusions occupying $\geq$1/2 of the hemithorax (LR 13.5), pleural fluid pH $\leq$7.15 (LR 6.2), pleural fluid glucose $\leq$40 mg/dL (LR 5.6), pus (LR 4.8), positive pleural fluid cultures (LR 3.6), and pleural fluid lactate dehydrogenase >2000 U/L (LR 3.4). In the logistic regression analysis only the first two were selected as significant predictors of CPPE. In non-purulent effusions, the effusion's size and pleural fluid pH retained their discriminatory properties, in addition to a pleural fluid C-reactive protein (CRP) level >100 mg/L.
Conclusion: Large radiological effusions and a pleural fluid pH $\leq$7.15 were the best predictors for chest drainage in patients with PPE. In the subgroup of patients with non-purulent effusions, pleural fluid CRP also contributed to CPPE identification.

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PALABRAS CLAVE
Empiema;
Derrame paraneumónico;
Derrame pleural;
Drenaje torácico

Factores que influyen en el drenaje del derrame pleural paraneumónico

Resumen
Objetivo: La identificación de los derrames paraneumónicos (DP) que precisan drenaje pleural es problemática. Se ha intentado establecer la precisión diagnóstica de los hallazgos radiológicos y del líquido pleural para distinguir entre los DP que precisan drenaje (DP complicado) y aquellos que podrían remitir solo con tratamiento antibiótico (DP no complicado).
Sujetos y métodos: Revisión retrospectiva de 641 DP consecutivos, de los cuales 393 fueron clasificados como complicados y 248 como no complicados. Se compararon los datos demográficos, radiológicos (tamaño y lateralidad en radiografía de tórax) y los parámetros del líquido pleural (pus, cultivos bacterianos, bioquímicas) entre ambos grupos. Para establecer qué variables son más útiles al predecir el drenaje torácico se llevó a cabo una regresión logística, y las curvas de rendimiento diagnóstico ayudaron a seleccionar los valores de corte.
Resultados: Según el cociente de probabilidad (CP), los hallazgos que aumentan la probabilidad de drenaje torácico son: derrames que se expanden por $\geq$ 1/2 del hemitórax (CP 13,5), pH del líquido pleural $\leq$ 7,15 (CP 6,2), glucosa del líquido pleural $\leq$ 40 mg/dL (CP 5,6), pus (CP 4,8), cultivos bacterianos positivos del líquido pleural (CP 3,6) y LDH en líquido pleural > 2.000 U/L (CP 3,4). En el análisis de regresión logística solo los 2 primeros se clasificaron como factores predisponentes de DP complicado. En los derrames no purulentos el tamaño del derrame y el pH del líquido pleural mantuvieron sus propiedades discriminatorias, además de la proteína C reactiva (PCR) en líquido pleural >100 mg/L.
Conclusión: Los derrames grandes y un pH del líquido pleural $\leq$ 7,15 fueron los mejores factores predisponentes para el drenaje torácico en pacientes con derrame paraneumónico. En el subgrupo de pacientes con derrames no purulentos, la PCR del líquido pleural también contribuyó a la identificación del DP complicado.

Introduction

Ensuring prompt and complete drainage, when indicated, is a basic principle for managing pleural infections. The rationale is that delays in initiating necessary drainage increase morbidity and mortality. The American[1] and British[2] guidelines for identifying those patients with parapneumonic effusions (PPE) who are at greatest risk of poor outcome and, thus, need an urgent pleural drainage procedure (i.e., complicated PPE (CPPE)) have been largely adopted by clinicians. They establish that drainage should be strongly considered if any of the following factors are present: pus (empyema), large effusions ($\geq$1/2 of the hemithorax on a chest radiograph), positive pleural fluid cultures or pleural fluid pH <7.20. However, these recommendations are based on limited evidence, mainly small case series and expert opinions. In the last few years, a number of promising CPPE pleural fluid markers, such as the C-reactive protein (CRP), have been tested, but none have gained acceptance in daily practice.[3]

We sought to determine, in the largest series reported to date, the utility of the preceding radiological and pleural fluid findings as indicators of the need for chest drainage in the setting of PPE.

Subjects and methods

We carried out a retrospective review of all consecutive adult patients subjected to a diagnostic thoracentesis at the Arnau de Villanova University Hospital (Lleida, Spain) during the last 20 years, whose final diagnosis was established to be a PPE. The local ethics committee approved the study protocol.

A PPE referred to any exudative effusion associated with bacterial pneumonia, lung abscess or bronchiectasis. Empyema was defined as pus within the pleural space. Patients with pleural infections unrelated to pneumonic processes (e.g., surgery, sub-diaphragmatic infections, esophageal perforation, trauma, spontaneous bacterial pleuritis, septicemia) and those who died before hospital discharge were excluded from the analysis. CPPE were defined as those effusions requiring chest drainage (mainly tube thoracotomy and, less commonly, therapeutic thoracenteses or surgery). In contrast, uncomplicated PPE (UPPE) described those that were resolved with antibiotics only. Decisions on whether to insert a chest tube were made by the attending physicians.

The following parameters were recorded: demographics, size and laterality of pleural effusions on chest radiographs, purulent fluid appearance, pleural fluid cultures and pleural fluid biochemistries. The latter included red blood cell count, leukocyte count and differential, protein, lactate dehydrogenase (LDH), adenosine deaminase (ADA), CRP, glucose and pH. Effusion size was evaluated from a posteroanterior radiological viewpoint, whenever possible, by visually estimating the area of the lung filled with pleural fluid. For example, when the meniscus of the fluid reached the hilum, the effusion was deemed to occupy half of the hemithorax.

The aspirated fluid was immediately transferred from syringe to sterile heparinized tubes for analyses.

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