



Review Article

Non-traumatic and spontaneous hemothorax in the setting of forensic medical examination: A systematic literature survey



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ABSTRACT

Spontaneous hemothorax is a well-known yet seldom-reported entity in forensic literature. While trauma-related hemothorax is frequently encountered in a medicolegal setting, non-traumatic and spontaneous hemothorax are relatively uncommon entities. The wide range of causes that can trigger fatal intrathoracic bleeding include thoracic aortic dissection, followed by vascular malformations, various oncological diseases, and connective tissue abnormalities. In rare instances, extramedullary hematopoiesis, ectopic pregnancy, congenital heart defects, amyloidosis, or parasitic diseases may constitute a source of bleeding. This etiological heterogeneity may, as a result, cause diagnostic difficulties during post-mortem elucidation of hemothorax. It should be borne in mind that hemothorax after low-energy trauma does not exclusively indicate traumatic hemorrhage, hence, the non-traumatic origin of bleeding must be taken into consideration. In this paper, we present a systematic review of the relevant literature enriched by the results of our observations to investigate the etiologies and recommendations for the post-mortem diagnosis of spontaneous hemothorax in an attempt to better delineate the possible medicolegal considerations. It is important that forensic pathologist as well as clinicians are aware of the diseases that could potentially give rise to fatal hemothorax.

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1. Introduction

Hemothorax as a specific clinico-pathological entity can be defined in two ways. Morphologically, hemothorax is a pathologic accumulation of blood within the pleural cavity, between the lung surface and inner chest wall. From the clinical viewpoint,

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hemothorax is defined as the extraction of pleural fluid with a hematocrit ranging from at least 25–50% of peripheral blood [1]. It is important to realize that even hemothorax can appear as a hemorrhagic effusion with lower levels of hematocrit because there is a significant dilution in 3–4 days [1]. Moreover, levels of hematocrit in the blood need to be interpreted with knowledge of the phenomenon of postmortem hemolysis, especially with respect to the duration of the postmortem interval. Etiologically, hemothorax may be consequence of trauma or may develop spontaneously. Trauma-related hemothorax is finding frequently encountered in a medicolegal setting. Hemorrhage into the pleural space occurs to some degree in almost every individual with a diagnosable thoracic injury [2]. Many blunt force injury cases, such as those that occur in vehicular collisions and following falls or jumps from heights, are often associated with fatal hemothorax. In addition, penetrating thoracic injuries produced by stab or gunshot wounds frequently lead to traumatic hemothorax. On the other hand, non-traumatic or spontaneous hemothorax is relatively uncommon event. The wide range of pathologic processes that may trigger intrathoracic bleeding includes rupture of thoracic aortic dissection or aneurysm, spontaneous pneumothorax, pulmonary emboli, tuberculosis, various neoplasms, hematological abnormalities, connective tissue disorders, chest wall exostoses, and anticoagulants administration. Even infectious or parasitic diseases such as malaria or echinococcosis are capable of initiating non-traumatic bleeding into the chest cavity. In rare instances, ectopic pregnancy, pleural adhesion rupture, congenital heart defects, systemic diseases, extramedullary hematopoiesis or rare forms of malignancies may constitute the source of bleeding. Massive hemothorax is an infrequent, but potential life-threatening complication of various iatrogenically-related procedures such as cardiopulmonary resuscitation, central vein catheterization, needle thoracocentesis, pleural or lung biopsies, and endoscopic thoracic interventions. The literature is abundant with dispersed reports concerning spontaneous hemothorax with a fatal and non-fatal outcome. In spite of this, an extensive literature search failed to find a medicolegally oriented review of spontaneous hemothorax. Spontaneous hemothorax may raise diagnostic challenges both in a clinical and medicolegal setting, particularly in cases of sudden death with lack of circumstantial information from the death scene. Hemothorax after minor injury does not exclusively indicate traumatic bleeding and a full post-mortem search for pathologic processes is essential. In cases of hemothorax of uncertain origin a systematic approach along with the ancillary studies and special autopsy techniques is required and highly recommended. This paper, although limited by the rarity of the condition, provides a systematic review of the published literature describing pathogenic etiologies of spontaneous hemothorax and suggests diagnostic recommendations for each major entity.

2. Methods

In order to provide a comprehensive review on the spontaneous hemothorax, we carried out a careful PubMed search to identify all papers and book chapters in English during the period 1946–2012. The MedLine search was performed the following keywords: “non-traumatic hemothorax”, and “spontaneous hemothorax”. The search identified over 580 search results. After a careful analysis of the articles, approximately 130 medico-legal and pathologic-anatomic studies met the inclusion criteria and were included. In addition, several brief reports and the articles from references of the abovementioned papers, which could not be identified from MedLine, were also added to this review. The relevance of the articles was assessed by two co-authors (L.S., J.H.). We included only those studies published in English peer-reviewed journals that added an original contribution to the literature.

3. Results

3.1. Vascular disorders

Generally, the most common non-traumatic cause of hemothorax in deaths is rupture of thoracic aortic dissection [3]. Arterial hypertension followed by atherosclerosis is the most important factor in developing aortic dissection [4]. In this regard, review of the decedent's past medical history is always pertinent to the dissection and examination of the organs. Bode-Jänisch et al. concluded in their histopathological study that atherosclerotic lesions were the cause of aortic dissecting aneurysms in 68% of cases [5]. Less common causes of fatal hemothorax include rupture of a saccular aortic aneurysm and traumatic rupture of the pericardial sac during cardiopulmonary resuscitation in individuals with hemopericardium [3]. Recently, Monteiro et al. reported an autopsy case of spontaneous hemothorax during early puerperium in a young woman, where ruptured thoracic aortic aneurysm was secondary to chronic inflammatory process of the aortic wall [6]. Indeed, fatal spontaneous dissection of supra-aortic vessels without any evidence of aortic disease may occur, particularly during pregnancy and early puerperium [7]. Several authors have investigated if a bronchial artery aneurysm rupture was the cause of spontaneous hemomediastinum and hemothorax [8–11]. Spontaneous massive hemothorax rarely originates from the aneurysmatic internal thoracic artery, intercostal vessels, internal mammary artery aneurysm, or pulmonary congenital aberrant vessels [12–17]. Aberrant vessels are prone to trauma, such as deceleration or blunt force injuries [12]. Carrel et al. reported two fatal cases of ruptured mycotic aneurysms infected with *Staphylococcus aureus* [18]. Each patient had hemoptysis and in each case there was hemothorax caused by a ruptured mycotic aneurysm of the coeliac trunk. Kaul et al. reported a massive right-sided hemothorax secondary to an innominate truncal dissection [19]. Because dissection may disrupt the topo-anatomical continuity and thereby obscure the site of hemorrhage, the origin of initial hemorrhage should be investigated in situ. Leaving the entire length of the thoraco-abdominal aorta attached to the aortic arch and heart may best demonstrate cause of hemothorax such as thoracic aortic dissections, ruptured aortic aneurysms, or acquired aortic diseases. In cases requiring a more detailed vascular dissection for example, when indicated by the medical history or by postmortem computed tomography, or there is a demand to demonstrate patency of surgical anastomoses it may be best to perform the dissection of the pertinent vasculature before removing organs from the cervicothoracic block. In particular cases, use of postmortem computed tomography angiography (PMCTA) prior to conventional autopsy may provide supportive evidence of autopsy findings suggestive of spontaneous hemothorax (detecting thoracic aortic lesions, aneurysms, site of hemorrhage, etc). Wayne and Spitz were confronted with a previously healthy heroin addict, who died suddenly of hemothorax due to rupture of a subclavian artery aneurysm [20]. He had been using his neck veins for mainlining. Toxicology can be very helpful when drug interaction or drug intoxication is a possible cause of spontaneous hemothorax.

Several case studies in the literature reported hemothorax associated with pulmonary arteriovenous malformations (AVMs) [21–24]. Fatal and non-fatal AVM-associated massive hemothorax is often linked to Osler–Weber–Rendu disease [25–30]. Osler–Weber–Rendu disease (hereditary hemorrhagic telangiectasia, HHT) is an autosomal dominant hereditary disease of blood vessel walls characterized by arteriovenous malformations of the multiple organs and telangiectases of the mucous membranes and dermis that result in tortuous, dilated vessels. HHT is marked by spontaneous recurrent epistaxis, multiple mucosal/skin

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