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Pneumomediastinum in COVID-19 Patients

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Introduction- Emerging infectious diseases, such as severe acute respiratory syndrome (SARS), present a major threat to public health. In December 2019, a novel coronavirus referred to as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was identified as the causative agent of a respiratory syndrome named coronavirus disease 2019 (COVID-19). Since then, the pandemic has escalated. The spectrum of COVID-19 presentations ranges from mild self-limited flulike illness to severe viral pneumonia leading to acute respiratory distress syndrome that can be potentially fatal.

Within this context, other complications from COVID-19 pneumonia are expected, such as pneumomediastinum. Reports of cases of spontaneous pneumomediastinum have increased due to the current COVID-19 pandemic. To date, 43 articles on COVID-19 and pneumomediastinum have been published in PubMed.[1]

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Pneumomediastinum in COVID-19 Patients

Sebastián Campbell-Quintero [α], Santiago Campbell-Quintero [σ] & Santiago Campbell-Silva [ρ]

I. Introduction

Emerging infectious diseases, such as severe acute respiratory syndrome (SARS), present a major threat to public health. In December 2019, a novel coronavirus referred to as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was identified as the causative agent of a respiratory syndrome named coronavirus disease 2019 (COVID-19). Since then, the pandemic has escalated. The spectrum of COVID-19 presentations ranges from mild self-limited flulike illness to severe viral pneumonia leading to acute respiratory distress syndrome that can be potentially fatal.

Within this context, other complications from COVID-19 pneumonia are expected, such as pneumomediastinum. Reports of cases of spontaneous pneumomediastinum have increased due to the current COVID-19 pandemic. To date, 43 articles on COVID-19 and pneumomediastinum have been published in PubMed.[1]

In general, the physiopathological basis of this disease is based on the existence of a pressure gradient between the alveolus and the pulmonary interstitium. Once the alveolar rupture occurs, air passes from the interstitium to the hilum and then to the mediastinum due to the pressure difference between the latter and the pulmonary periphery which is known as the Macklin effect.[2]

SARS-CoV-2 can affect the pulmonary terminal structure, causing alveolar exudation and lymphocytic infiltration of the pulmonary interstitium. In advanced stages, SARS-CoV-2 can cause diffuse alveolar damage, which may lead to alveolar rupture and, therefore, pneumomediastinum.

a) Confusion about terminology of spontaneous pneumomediastinum

The common use of “chaos” refers to a state of confusion and disorder. Hence, things associated with disorder and confusion are called "chaotic".

This is the perception we have when reading articles about pneumomediastinum and especially about spontaneous pneumomediastinum. Pneumomediastinum is the term used to characterize the presence of air in the mediastinum, and the expression spontaneous pneumomediastinum describes the presence of air in the mediastinum with no specific cause.[3,4] Despite numerous published reports on this condition, there is no consensus on its terminology and classification, and the term "spontaneous pneumomediastinum" does not correspond with the definition in most publications. Most reports consider cases with predisposing or triggering factors as "spontaneous". This should not be so because it leads to confusion and controversy in the literature.

Allows to the term "spontaneous pneumomediastinum" to be used even when a causal factor has been identified, causing further chaos, rather than clarification. The lack of clarification leads to disputes among authors, complications in teaching, and confusion to readers.

The adjective "spontaneous” means an event without apparent cause, or that which arises suddenly. If we define spontaneous pneumomediastinum correctly, that is, “the presence of air in the mediastinum of healthy individuals without a causal factor” (predisposing or precipitating) and later affirm that it can be caused by factors such as smoking, asthma, the use of recreational drugs,[3,4]and recently COVID-19 pneumonia, we contradict ourselves. Nor can it be said that spontaneous pneumomediastinum is associated with several lung diseases without specifying the type of association because it creates ambiguity.

Some authors consider a pneumomediastinum which occurs outside of trauma (iatrogenic or non-iatrogenic) to be spontaneous, regardless of whether there is a non-traumatic predisposing or precipitating factor. However, these factors contribute indirectly or directly to the development of a pneumomediastinum. These cases do not correspond with the definition of a spontaneous pneumomediastinum.

Pneumomediastinum that results from an exertional esophageal perforation (Boerhaave syndrome) or as a complication of an esophageal foreign body cannot be called spontaneous. This is because the immediate cause of esophageal perforation is exertion due to nausea and severe vomiting, and the presence of an esophageal foreign body results in asphyxiation (both are non-traumatic

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precipitating factors). Furthermore, this condition can occur in both healthy individuals and individuals with underlying lung disease. Likewise, a pneumomediastinum that occurs with anorexia nervosa, Marfan syndrome, Ehlers-Danlos syndrome, malnutrition, dermatomyositis, polymyositis, diabetic ketoacidosis, ulcerative colitis, or COVID-19 is not spontaneous.

If a patient has a previous condition such as asthma or another underlying lung disease such as COVID-19 pneumonia and a coughing fit causes a pneumomediastinum, should we call this condition spontaneous pneumomediastinum? Similarly, if a healthy person experiences intense vomiting for any reason and a pneumomediastinum occurs, should we call this condition spontaneous pneumomediastinum?

These cases have factors that increase the risk of developing a pneumomediastinum and should not be called spontaneous pneumomediastinum. In the former case, there is a predisposing factor, either congenital or acquired. If a patient develops COVID-19 pneumonia prior to the development of a pneumomediastinum, it is then the respiratory disease that contributes to the increased susceptibility to this disorder. In the latter case, a precipitating factor is present, which causes a sudden increase in intra-alveolar pressure resulting in rupture and appears just before the episode of pneumomediastinum. This can occur in patients with or without underlying lung disease. It is important to differentiate the two cases in order to classify pneumomediastinum properly through an adequate medical history.

Perhaps we are accustomed to referring to this type of pneumomediastinum as spontaneous. Keeping with customary terminology, the same could be said of other situations such as spontaneous abortion, spontaneous pneumothorax, or spontaneous esophageal perforation. However, custom is one thing, and the appropriate terminology is another.

II. Pneumomediastinum Classification

Pneumomediastinum can be divided into two groups: primary and secondary pneumomediastinum (Figure 1). We believe that this classification is more precise and explanatory than those published previously. [3,4]

The term "primary pneumomediastinum" should be used for cases of pneumomediastinum that occur in the absence of predisposing and precipitating factors. The term "secondary pneumomediastinum" should be used when there is a predisposing or precipitating factor or both.

The term "primary" usually refers to the fact that there is no known underlying disease, and the term "spontaneous" means that there is no known cause; however, several authors imply that predisposing and precipitating factors are present in both terms.

Many authors consider a primary pneumomediastinum to be a pneumomediastinum which occurs in previously healthy individuals and is triggered by a non-traumatic precipitating factor, such as a coughing fit or intense exercise. Others regard this as spontaneous. This pneumomediastinum is neither spontaneous nor primary, but secondary to an episode of coughing or intense exercise in a previously healthy person. The primary pneumomediastinum is itself spontaneous, idiopathic, or Hamman's syndrome.

If a primary pneumomediastinum is suspected, additional diagnostic procedures, such as bronchoscopy, esophagogram, or esophagoscopy, may be necessary to rule out a secondary cause. This would result in a diagnosis by exclusion, which is not clinically relevant for cases of secondary pneumomediastinum. In general, the treatment and prognosis of primary pneumomediastinum is similar, unlike secondary pneumomediastinum. Treatment and prognosis of this pneumomediastinum depends on complications from precipitating factors in the presence or absence of underlying lung disease, not the pneumomediastinum itself. Differentiating between primary and secondary pneumomediastinum thus impacts patient outcome.

Primary pneumomediastinum is exceptionally rare, but its existence cannot be denied.[5] For these exceedingly rare cases, the abnormal condition causing the air leak would remain unclear. Until a cause is determined, we must call it primary.

In the literature, there are many expressions, such as “primary spontaneous pneumomediastinum” and “idiopathic spontaneous pneumomediastinum”, which suggest that there are different terms for the same condition. Furthermore, stating that idiopathic pneumomediastinum is a form of spontaneous pneumomediastinum[5] is inappropriate because both terms are referring to the same condition.

When a precipitating factor for pneumomediastinum exists, it is not appropriate to use phrases such as “primary spontaneous pneumomediastinum” and “secondary spontaneous pneumomediastinum” to differentiate between a pneumomediastinum in which there is no underlying lung disease predisposing air leakage. Therefore, the word "spontaneous" should be omitted.

It is preferable to use the term primary pneumomediastinum and not spontaneous pneumomediastinum, although they refer to the same condition. From chaos must be born order.

III. Conclusion

Pneumomediastinum due to COVID-19 is not spontaneous because there is a pre-condition like SARS-CoV-2 pneumonia.

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In general, pneumomediastinum cannot be spontaneous when a predisposing or precipitating factor or both are identified.

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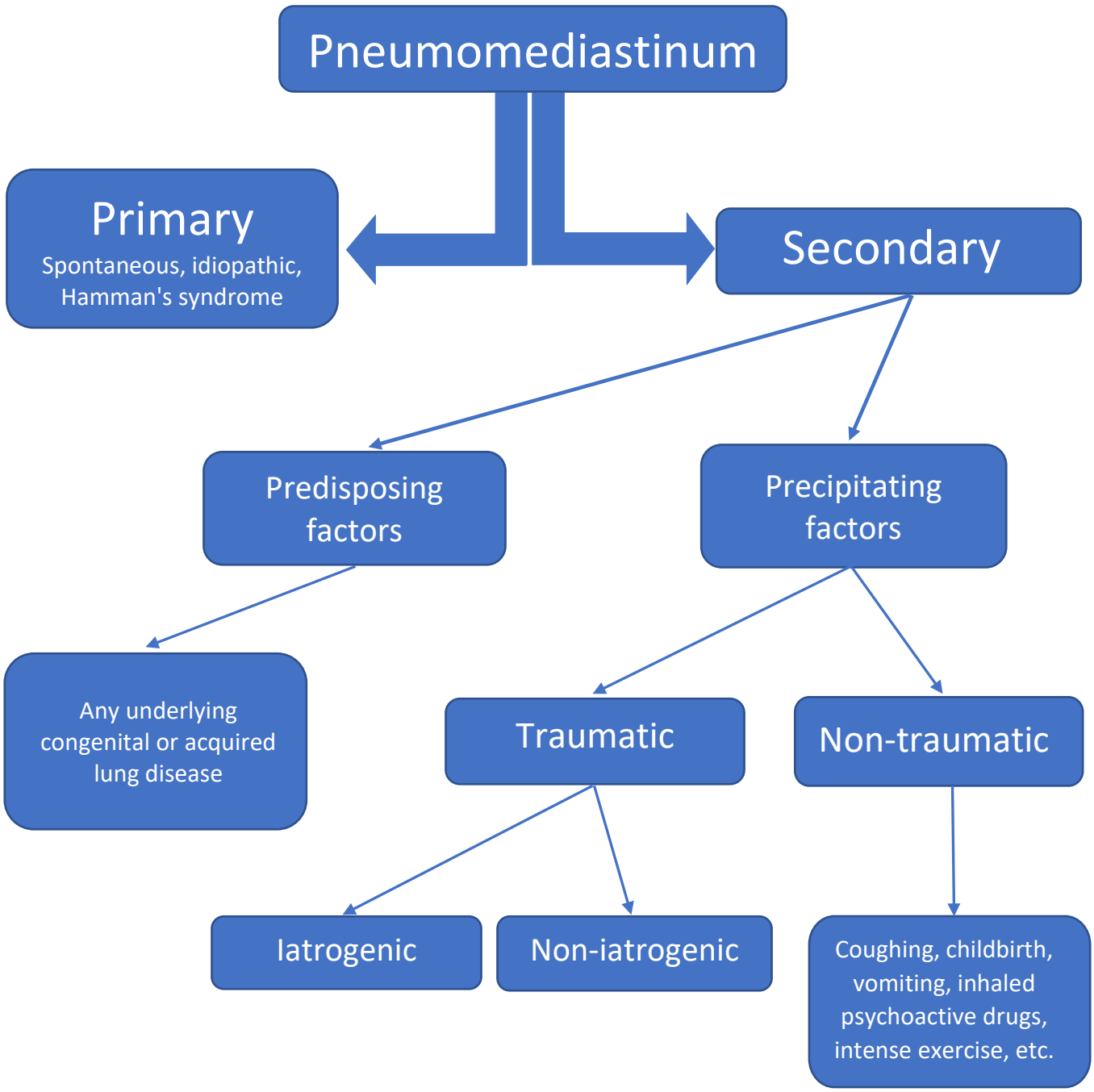


Figure 1: Pneumomediastinum classification

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