Pulmonol. 2020;26(4):184–185

PULMONOLOGY

www.journalpulmonology.org

EDITORIAL

End-tidal carbon dioxide and alveolar dead space – an alternative in the diagnosis of acute pulmonary embolism?

Acute Pulmonary Embolism (PE) has been identified as one of the leading causes of deaths worldwide. Exact or nearly exact numbers only exist in the western hemisphere e.g. in North America and Western, Europe. It seems to be clear that mortality depends on early diagnosis followed by proper treatment by which mortality rates fall from over 39% to below 10%.

The high variability of clinical symptoms or the lack of symptoms whatsoever helps to establish an exact diagnosis with or without suspicion as early as possible. Mortality rates are high since 50% of patients with suspicious PE do not have any symptoms. Computed tomography (CT) pulmonary angiography is the gold standard for diagnosing PE.[1]

The ability to rule out PE was already demonstrated by Kline et al.,[2] over 20 years ago by combining alveolar dead space fraction calculations and plasma D-dimer levels. A normal alveolar dead space fraction and a negative D-dimer shows a high sensitivity (100%) to excluding PE in outpatients, however specificity was only 65%. Steady-state end-tidal alveolar dead space fraction and D-dimer were used also as bedside tests to exclude PE.[3] Measuring end-tidal CO_2 tension was also used as a screening tool to exclude PE.[4–6]

In the current issue of *Pulmonology* Yucel et al.,[1] stated that the combined use of end-tidal carbon dioxide ($ETCO_2$) and alveolar dead space fraction (AVDSf) values is an important and valuable tool in diagnosing PE, a very important diagnosis in internal medicine, cardiology, pneumonolggy and other specialities in medicine. In that study[1] one-hundred patients with suspected PE were included and evaluated using clinical prediction rules – Wells score – and the modified Geneva score.[7,8] Pulmonary embolism was ruled out with normal D-dimer analysis (<0.55 mg/dl). Patients' ET CO_2 values were measured using time versus waveform capnography before performing CT-angiography. Simultaneously arterial puncture was performed for arterial blood gas analysis. Pulmonary embolism was detected in 36% of patients and classified into high-, moderate-, and low-risk groups according to the Wells- and modified Geneva scores, respectively, when ETCO2 was 28.5 mmHg. Diagnosis of acute or subacute PE was excluded in 100% of patients with low Wells- and Geneva-scoring system with AVDSf < 0.128. On the other hand high Wells- and high modified Geneva scores were helpful in diagnosing PE based on ETCO2 and AVDSf values calculated using capnography as a simple bedside measure with clinical prediction rules and D-dimer test using an alternative?[4–6] Several similar studies have been performed using this method described in the article of this issue.

Kline et al.,[2] were the first to show the ability to rule out PE by combining alveolar dead space fraction calculations and plasma assays. In 70 outpatients the combination of a normal alveolar deadspace fraction and a negative D-dimer fraction showed a 100% sensitivity to excluding PE with a lower sensitivity of only 65%. Rodger et al.,[9] reported 246 patients (inpatients, outpatients and patient admitted to the emergency ward) with suspected PE. Pulmonary embolism was excluded with a negative D-dimer result and a sensitivity of 83% and a specificity of 58%. At low steady state end tidal alveolar dead space fraction PE was excluded with a sensitivity of 80%, and a specificity of 70%. And again the combination of both diagnostic tests – end-tidal alveolar dead space fraction and D-dimer – increased the sensitivity to 98%, therefore ruling out acute or subacute PE without further diagnostic testing.

Despite its noninvasiveness and rapid availability, measuring $ETCO_2$ gradient for assessing alveolar dead space has not been regularly performed. Technical limitations and the lack of validation together with rather difficult data acquisition and a weak diagnostic performance were the main obstacles. Last but not least the strategy used by Yucel et al.,[1] is a non-invasive method without using radionucleids and radiation. This is very important in patients who may suffer PE during pregnancy which is quite common and very often overlooked condition for which patients do not receive appropriate therapy as and when needed.

https://doi.org/10.1016/j.pulmoe.2020.03.006

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Available online 7 June 2020