

Modern Trends in Early Diagnosis of Acute Respiratory Distress Syndrome

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Acute respiratory distress syndrome (ARDS) is a noncardiogenic pulmonary edema, in the basis of which lies an alteration (dystrophy, necrosis, apoptosis) of alveolar epithelium, pulmonary microcirculation endothelium, and their basal membranes (including structures of aerohematic barrier) by endogenous and exogenous aggressive factors, leading to vascular permeability growth and development of acute respiratory failure [1,2].

For many years since its first description in 1967 [3] ARDS has remained a critical condition with a high morbidity and mortality [4], which is in great deal due to an inability of the currently used clinical ARDS criteria to detect the early stage of the syndrome. The problem of prompt diagnosis is of great significance for critical care medicine: the earlier we diagnose the critical condition, the broader spectrum of treatment approaches we have and the better are the outcomes.

Three diagnostic tools for ARDS are currently available: the Murray score [5], the American-European consensus conference criteria [6], the Delphi criteria [7]. The Murray score is not designed to differentiate between stages of ARDS and no data exist that this score correlates with outcomes [8]. The widely used American-European consensus conference criteria are based on oxygenation index and chest X-ray. Oxygenation index decrease is an important marker of ARDS, but is highly dependent on numerous clinical variables apart from ARDS (pneumonia, atelectasis, bronchial obstruction etc). The chest X-ray, especially made by a portable machine, is not informative for the diagnosis of early ARDS stage: bilateral pulmonary infiltrates are only detected at later stages [1,2,9,10]. The Delphi criteria, which take into account the influence of positive end-expiratory pressure on oxygenation index, did not win popularity among clinicians [7]. The recent definition of ARDS proposed at the 2011 ESICM Annual Congress deals not only with routine criteria, but also with the timing, physiological derangements and 3 degrees (mild, moderate and severe) of ARDS. This is a step forward for diagnosing an early ARDS stage. But none of the abovementioned criteria are based on the pathogenesis of the early ARDS stage.

Pathogenesis, diagnosis and treatment of ARDS have long been an area of interest for the scientists of the V.A. Negovsky scientific research institute of general reanimatology. A multicenter investigation (pathological, experimental, clinical) carried out at the V.A. Negovsky scientific research institute of general reanimatology in 2000-2011 confirmed that the *non-cardiogenic pulmonary edema* is the crucial element of the pathogenesis of early ARDS stage and a key for its detection in the clinical setting. Interstitial and alveolar pulmonary edema is seen within 2-3 hrs after the direct or indirect insult to the lung [1,2,9,10]. Therefore, signs of pulmonary edema should be the most reliable for diagnosing an early ARDS. Clinically the non-cardiogenic pulmonary edema can be reliably detected and dynamically monitored by the transpulmonary thermodilution using the extravascular lung water index (EVLWI), which was confirmed in an array of investigations [1,2,9-11].

The modern approach to diagnose an early ARDS stage based on the detection of non-cardiogenic pulmonary edema was developed at the V.A. Negovsky scientific research institute of general reanimatology (Table 1). These criteria provided clinicians with a possibility to diagnose *early, reversible stage of ARDS* and start prompt treatment which improves outcome. These complex strategies made it possible to decrease the duration of artificial pulmonary ventilation by 4-7 days, the intensive care unit stay by 5-6 days, the hospital stay by 10 days, the rate

• Acute onset
• Extravascular lung water index >7 ml/kg
• Oxygenation index <300 mmHg
• No left-ventricular insufficiency
• No signs of ARDS in direct chest X-ray

Table 1: Early ARDS stage new diagnostic criteria, developed at the V.A. Negovsky scientific research institute of general reanimatology [1-2].

of pulmonary complications by 31,9%, the price of treatment per patient by 130,000 RUB and the mortality- by 29,6% [1,2,9,10].

Therefore, the diagnostic algorithms in critical care medicine should be based on the pathogenesis of the critical state. The knowledge of the pathogenesis of the early ARDS stage made it possible to develop a modern diagnostic approach, which is effective and recommended to be implemented into a daily practice. Future research is focused on investigations into *novel biomarkers* of ARDS.

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