Exhaled breath analysis discriminates phenotypes of acute lung injury (ALI).  
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Introduction  
It has been postulated that the pathophysiology and clinical presentation of ALI based on pulmonary and non-pulmonary etiology represent different phenotypes. Until now, little biological evidence on the molecular level has been presented to support this hypothesis. Exhaled air contains volatile organic compounds (VOCs), metabolites of systemic or respiratory origin. Exhaled air metabolites may differ between diseases. Molecular profiling of exhaled air of intubated and mechanically ventilated ALI patients using an electronic nose might serve as a tool to phenotype patients rapidly and non-invasively.

Hypothesis  
We hypothesized that exhaled breath profiles differ between patients with pulmonary and non-pulmonary ALI.

Methods  
This study represented an interim analysis in a longitudinal diagnostic cohort of intubated and mechanically ventilated ICU patients admitted to the Academic Medical Center, Amsterdam. Patients with chronic pulmonary diseases were excluded. Consecutive patients with ALI according to international consensus criteria were included. Exhaled breath was sampled by a Cyranose 320, an electronic nose, for 60 seconds using a t-connector placed distal of the endotracheal tube, but proximal to the heat-moist exchanger. The electronic nose contains 32 polymer sensors, which change electrical resistance when bound by volatile organic compounds (VOCs) resulting in a unique “breathprint”. Sensor data are analyzed by principal component (PC) analysis. One-way ANOVA is used to compare groups and ROC-analysis was used to examine diagnostic values.

Results  
16 patients with ALI at admission were included. ALI was caused by a pulmonary insult in 7 patients (3 pneumonia, 2 aspiration, 1 contusion and 1 drowning) whereas 9 patients had a non-pulmonary (7 sepsis, 2 pancreatitis) and 5 patients had a combined cause for ALI. P/F-ratio, pressures and tidal volumes were not different between patient categories. PC4 was significantly different between patients with pulmonary and non-pulmonary ALI (p = 0.009) (figure 1). ROC-analysis showed good discrimination (AUC 0.84).

Conclusions  
Exhaled breath profiles obtained by an electronic nose discriminate between patients with pulmonary and non-pulmonary ALI.

Implications  
This indicates that metabolic pathways are differentially expressed between pulmonary and non-pulmonary acute lung injury. These pathways will be delineated using gas-chromatography and mass-spectrometry by separating, identifying and quantifying the discriminating VOCs.

References  
2. Friedrich MJ. JAMA. 2009;6,585-586  
Breathprints discriminate between patients with pulmonary (blue triangle) and non-pulmonary ALI (red triangle). Patients with a combination of causative factors (diamonds) are in between.