

Gas embolism during surgery. A complement mediated condition?

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**Background:** Venous air embolism (VAE) may arise during surgical procedures. VAE might be complicated with a systemic inflammatory response, disseminated intravascular coagulation, multi-organ failure and cardiovascular collapse. During a short time-span, three patients at our institution developed signs of VAE in conjunction with gynecological surgery. One died, one developed severe cerebral infarctions and one developed myocardial infarction.

Previously, air embolisms have been shown to trigger complement C3 and C5 activation in plasma. We have examined in vitro in human whole blood and in vivo in a porcine model, how air triggers inflammation and activation of complement and coagulation and their cross-talk.

**Materials and methods:** In vitro, air was bubbled through a human plasma pool and lepirudin anticoagulated whole blood treated with antifoam. Samples were analyzed for C3 activation products and TCC, and coagulation evaluated by prothrombin fragment 1 + 2 (PTF1 + 2). Various cytokines were also measured. In pigs, air was continuously infused intravenously, causing marked haemodynamic influence and kept stable for 4–5h, until final haemodynamic collapse.

In addition to the above-mentioned plasma analyses, lung tissue was analyzed for cytokine mRNA.

**Results and conclusions:** In plasma and whole blood, air triggered increase of C3a, C3bc, TCC and PTF1 + 2 and release of cytokines TNF, IL-1 $\beta$ , IL-8, IL-9 and IL-17. The interaction between complement, coagulation and cytokines is under current investigation. Pilot experiments of air infusion in pigs induced plasma thrombin–antithrombin complexes and syntheses of TNF, IL-6 and IL-8 in lung tissue.

Our preliminary data suggest that the complement and coagulation systems are directly activated by air contact, and that several mechanisms, including a possible cross-talk, is responsible for the activation. With the aim of future therapeutic interventions, we plan to decipher this cross-talk, by use of specific complement-, coagulation- and cytokine inhibitors.