

Reduction of Gaseous Micro-Embolie (GME) with use of a new Micro-Bubble Alarm Device (BCC 200®)

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Objectives:

GME is known to induce temporary and permanent neurological and neurocognitive defecits as well as exogene psychoses. This study discloses actions of surgeons, perfusionists and anaesthesiologists with elevated risk of GME and describes how gas pollution can be reduced with help of BCC 200® by conditioning of the open heart team.

Methods:

The BCC 200® uses ultrasound Doppler (2 MHz) to measure size (10 – 500 µm) and number of micro-bubbles – simultaneously in the venous inflow and in the arterial line behind the filter. Number and size of bubbles are transformed into acoustic signals notable to the whole open heart team. HITS were determined with a Pioneer TC 4040 allowing online recording. In more than 300 patients the BCC 200® was used during ECC, in 100 cases simultaneously high intensity transient signals (HITS) in the middle cerebral arteries were measured.

Results:

The total number of GME in the arterial outflow of ECC varied from 6848 to 10426 (mean 7768), the total volume from 3,25 to 5,25 µl (mean 4,14 µl). The number of HITS in the middle cerebral arteries significantly correlated with number and volume of GME. When appearing in the venous inflow of ECC, GME are only partially eliminated by the components of ECC.

Anaesthesia	Perfusionist	Surgeon
<ul style="list-style-type: none"> ▪ Medication via CVC** ▪ Volume administration ▪ Blood sampling via CVC** 	<ul style="list-style-type: none"> ▪ Start of CC* ▪ Medication ▪ Blood sampling ▪ Rapid volume administration ▪ De-airing of filter <p style="text-align: center;">} Via Reservoir</p>	<ul style="list-style-type: none"> ▪ Testing of venous grafts ▪ Partial aortic clamping ▪ Vent insertion ▪ Air-tight right atrial cannulation

* ECC: Extracorporeal Circulation ** CVC: Central Venous Cannula

Air-tight right atrial cannulation is the most important action to reduce GME.

Conclusions:

1. Number and volume of GME are only partially eliminated by the components of ECC correlate significantly with HITS in the middle cerebral arteries
2. In contrast in the human lung the capability of components of ECC to eliminate gas pollution is limited. Thus, during ECC, special care has to be taken to avoid gas also in the venous inflow.
3. Air-tight cannulation of the right atrium is highly effective to reduce GME.

4. Acoustic online warning against GME significantly contributes to reduction of gas pollution by conditioning of all actors of the open heart team.