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TITLE: AERIC MICROEMBOLI AND THE TRANSCRANIAL DOPPLER (TCD): EPISODIC FREQUENCY AND TIMING IN 62 CASES OF OPEN HEART SURGERY

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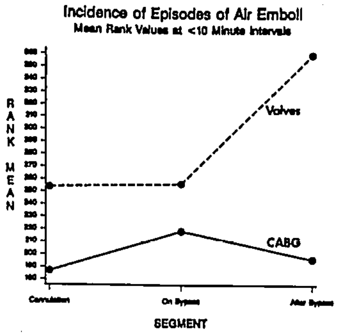
It is thought that the neurobehavioral dysfunction often seen after cardiopulmonary bypass procedures (CPB) may be due in a large part to micro-embolic phenomena. We report here the episodic frequency and timing of aeric microemboli in 10 patients subjected to aortic or mitral valve replacements (VR), and in 52 patients having coronary artery bypass graft (CABG) surgery. IRB and informed consent were obtained.

Using the pulsed Doppler probe of the TCD (Transpect-Medasonics) we imaged the middle cerebral artery of 62 patients (52 CABG and 10 VR) and a video-tape was made of each procedure. The tape of each procedure was reviewed and the episodes of air counted within a 10 min epoch during cannulation, on CPB, and immediately after bypass. The episodes in each 10 min epoch of the CABG group were compared to the VR group with a two way analysis of variance. The ANOVA was performed on rank scores of the frequencies to mitigate the extreme skewness of the raw frequency distribution. Episodes of air occurring after the 10 min epoch during cannulation, bypass, and after bypass, were also noted. The video-tapes were examined for velocity of flow patterns during bypass including periods of no flow through the middle cerebral artery. Low flow states were identified when the mean velocity of flow was less than 5.0 cm/sec.

The incidence of air increases dramatically for valve patients in the 10 min interval following the end of bypass (Fig 1). The effect is statistically significant ($p<.01$). In addition, the ANOVA also indicates that valve patients have more air than CABG patients ($p<.01$). In 1 VR and 8 CABG patients, <u>no flow</u> was observed in the MCA for periods ranging from 4 sec to 2 min 13 sec. Decreases in MCA flow velocity below 5 cm/sec^{-1} occurred in 2 VR and 24 CABG for periods ranging from 1 sec to 30 min.

It appears that the VR group is at greater risk for aeric microemboli when compared to the CABG. The incidence of aeric microemboli combined with the changes in velocity of flow (or no flow) may contribute to the postoperative neurobehavioral dysfunction seen in open heart surgery.

Incidence of Episodes of Air Emboli
Mean Rank Values at <10 Minute Intervals



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TITLE: THIOPENTAL LOADING AND HYPOTHERMIC CIRCULATORY ARREST FOR COMPLEX CEREBRAL ARTERY ANEURYSM SURGERY

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Thiopental (TP) may or may not protect the brain against focal cerebral injury, but it provides excellent neurosurgical anesthesia and is an ideal adjunct for aneurysm clipping under hypothermic circulatory arrest. Two recent reports, however, state that cardiac patients given large doses of TP just prior to and during cardiopulmonary bypass (CPB) required more inotropic support during weaning than controls.[1,2] This study examines the hemodynamic effects of TP loading in neurosurgical patients without concomitant cardiac disease who undergo CPB.

Patients with complex cerebral artery aneurysms, not amenable to clip application under standard operating conditions, were anesthetized with TP, fentanyl, N_2O, isoflurane and muscle relaxants and ventilated to a $PaCO_2$ of 29 mm Hg. They were monitored with intraarterial and pulmonary artery catheters and EEG (C_3-P_3, C_4-P_4). Prior to cannulation for CPB a TP infusion was titrated to an EEG burst-suppression ratio of 1:5. Core temperature cooling to 16°C preceded circulatory arrest for clip application. TP loading continued until shortly before weaning from CPB. A hemodynamic profile was obtained prior to the TP infusion (C), 30 min after loading began (TP) and 30 min after weaning from bypass (Off). Institutional approval and informed consent were obtained. Statistical comparisons were done by repeated measures analysis of variance and, if significant, differences between groups were isolated using Fisher's Progressive Least Squares Differences method.

Ten patients, ASA class 2 or 3, were studied. Mean age was 48 yrs (range 24-69). TP total dose given was 3.0 ± 0.4 gm (mean ± SE) or 42 ± 5 mg/kg; mean rate of TP infusion was 21 ± 2 mg/kg/hr. CPB lasted 124 ± 6 min, and the circulation was arrested for 18 ± 2 min. Cooling took 31 ± 3 min and rewarming 62 ± 4 min. Hct decreased from 35 - 25% with CPB.

	HR *b/min*	MAP *mmHg*	CVP *mmHg*	PAD *mmHg*	CI *L/min/m²*	SVI *ml/b/m²*	SVRI *units*
C	63 ± 3	82 ± 2	9 ± 1	12 ± 1	2.8 ± 0.2	45 ± 3	27 ± 2
TP	75 ± 3*	79 ± 2	9 ± 1	12 ± 1	2.8 ± 0.1	37 ± 1*	26 ± 2
Off	81 ± 3*	80 ± 4	11 ± 1+	15 ± 2+	3.6 ± 0.2+	45 ± 2°	20 ± 2+

* Significantly different from Control ($P<0.05$)
° Significantly different from Thiopental ($P<0.05$)
+ Significantly different from Control and Thiopental ($P<0.05$)

TP loading before CPB had only a minor effect on the hemodynamic profile; the decrease in stroke volume was compensated for by the increase in heart rate. All patients were weaned from CPB without inotropic support. The decrease in Hct was reflected in a lower systemic vascular resistance, and the cardiac output and stroke volume increased with the increase in heart rate and preload. All patients were somnolent postoperatively and ventilated overnight. All of them recovered and were discharged from the hospital.

These data support the view that neurosurgical patients without concomitant heart disease tolerate TP loading to burst-suppression followed by hypothermic CPB and circulatory arrest without the hemodynamic deterioration seen in cardiac surgical patients.[1,2]

References

1. Anesthesiology 65:165-170, 1986
2. Anesthesiology 74:406-411, 1991