

Title: A "BAND-AID" TO DETECT ALCOHOL LEVELS IN BLOOD

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A simple, noninvasive, low-cost method to detect and display concentrations of drugs in blood would enable monitoring to guide therapy, to guide behavior (such as not driving), or to verify that an individual is drug free. Transcutaneous chemical collection by a "Band-Aid"-like device (Dermal Systems International) that changes color with increasing concentration of drug in the blood has been reported as a novel method for the noninvasive measurement of body exposure to drugs and other chemicals.^{1,2} We tested the hypothesis that such a device could detect alcohol in the blood at a concentration greater than 0.06%.

After institutional approval and with patient consent, 11 volunteers of various socioeconomic and racial backgrounds participated in a double-blind study of the psychomotor effects of alcohol, benzodiazepines, saline, or placebo. Subjects had a "Band-Aid"-like patch placed in two areas, the back of the elbow and the forehead. Neither patch was visible to the subject. The patch consisted of a disk of semi-permeable barrier pad (to absorb the diffusing substances and prevent migration of the detector chemicals into the skin); a filter paper embedded with a detection enzyme and a reagent that changed color when exposed to alcohol; a transparent protective cover; and an adhesive backing. The materials for this patch cost only a few cents.

The color of these patches was rated on a 0 to 5 scale (0 = white, 5 = darkest green) by an observer unaware of the subject's consumption of alcohol and of a Breathalyzer® reading that was taken simultaneously. All patches were "active," although observers were told that 50% of the patches did not contain detection material. Patches on elbow and forehead were read separately. Color readings and Breathalyzer readings were taken 20, 30, 60, 80, 90, and 120 minutes after drug, alcohol, or placebo consumption.

Of the five subjects who did not ingest alcohol but received benzodiazepines, none had a color change observed in either patch. Each of the six subjects with blood levels of 0.06% alcohol as detected by Breathalyzer had color changes rated 3 or more, on both elbow and forehead patches, within 30 min of attaining that blood level of alcohol.

We conclude that a "Band-Aid"-like detection system for alcohol is inexpensive and easy to use; further, that an untrained observer can determine changes in color that correspond to blood levels of alcohol near those that may make driving unsafe. Different enzymes and color systems can be used to detect other chemicals, such as glucose, caffeine, nicotine, or estradiol. This system deserves more widespread testing as a personal detection device to monitor levels of drugs in blood inexpensively and noninvasively.

References:

1. Skin Pharmacol 1:14-23, 1988
2. Skin Pharmacol 2:155-161, 1989

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THE EFFECTS OF SUFENTANIL ON CBF, CMRO₂ AND CEREBRAL BLOOD FLOW VELOCITY IN DOGS

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This study investigates the cerebral hemodynamic and metabolic effects of sufentanil in dogs and correlates cerebral blood flow (CBF) obtained by microspheres with cerebral blood flow velocities obtained by transcranial Doppler sonography (TCD). Following approval of the Institutional Animal Care Committee, 10 mongrel dogs were anesthetized with isoflurane and catheters were inserted into both femoral arteries, veins and the sagittal sinus for blood pressure (BP) measurement, blood sampling and calculation of CMRO₂, respectively. Temperature, arterial blood gases and pH were maintained constant. Radioactive microspheres were injected via a left atrial catheter for determination of cortical CBF. A pulsed TCD-probe (8 MHz, TC2-64 B™, EME) was placed on the dura via a temporal window to obtain mean flow velocity (Vmean) and pulsatility index (PI = (Vsyst-Vdiast)/Vmean) in the MCA. At the end of surgery all animals were equilibrated at 0.5 MAC isoflurane in 50% N₂O/O₂ for 30 min. Following control measurements, 20 µg/kg sufentanil were injected and data were obtained at 5, 15 and 30 minutes following sufentanil administration. In group 1 (n=5), BP was not controlled following sufentanil while in group 2 (n=5) BP was maintained constant by phenylephrine infusion.

BP in group 1 decreased from 120±10 mmHg (mean±SE) at control to 87±14 mmHg 5 min following sufentanil (p<0.05). According to the protocol, no change in BP was seen in group 2.

CBF, Vmean and CMRO₂ response to sufentanil were not different between groups. Data in figure 1 and table 1 are combined for all animals. Figure 1 shows relative changes of CBF and Vmean from 100 % of control. The correlation between relative changes of CBF and Vmean was r = 0.82 for all measurements. The decreases in CBF following administration of sufentanil are more closely related to decreased metabolic demand than to decreases in BP. Cerebral vasoconstriction was indicated by a decline in CBF and a resistive TCD-flow pattern (PI↑). TCD provides noninvasive and continuous monitoring of changes in cerebrovascular hemodynamics with a close correlation to changes in CBF following sufentanil.

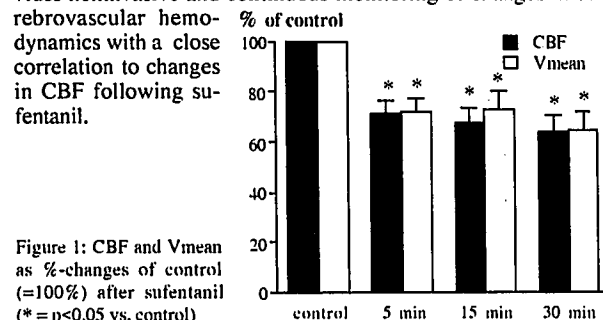


Figure 1: CBF and Vmean as %-changes of control (=100%) after sufentanil (* = p<0.05 vs. control)

time (min)	CBF (ml/100g/min)	CMRO ₂ (ml/100g/min)	Vmean (cm/s)	PI
control	138±15	5.8±0.4	36±2	0.64±0.03
5	97±12*	4.4±0.2*	26±4*	1.19±0.15*
15	90±10*	4.1±0.2*	25±4*	1.19±0.16*
30	83±10*	3.9±0.3*	23±3*	1.22±0.14*

Table 1: CBF, CMRO₂, Vmean and PI at control and after sufentanil (* = p<0.01 vs. control)