TITLE: CLINICAL EVALUATION OF THE "PRIVATE EYE": A "HEADS-UP" DISPLAY OF ANESTHESIA DATA

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Introduction. With the ever-increasing number of monitors in the operating room, the amount of data has increased also. The organization of this data is a problem, since different monitors have different display formats and different data locations. The field of vision that the anesthesiologist must scan is wide (horizontal scan) and high (vertical scan). Often the anesthesiologist's back will be to the monitors, when he or she is occupied with other tasks.

Methods and Materials. A new "heads-up" display, the "Private Eye" (Reflection Technology, Waltham, Massachusetts) has recently become available. This device has a small monocular display (1.0" x 0.9") attached to a headband. The display should be worn on the dominant eye - the eye that one would use to look through a camera or a telescope. It can be used by those who wear glasses and by those who do not. The focusing distance can be altered so that the display is in focus at an apparent distance of nine inches through infinity. In this way a user can see the display and a working area without a change in focus. The display can be worn directly in front of the eye, but a better position is slightly below the horizontal in a "reading bifocal" position. The display presents a monochrome image at 640 x 200 resolution and is compatible with the IBM "CGA" display. A custom interface board fits into a standard card slot of an IBM-compatible computer and connects to the Private Eye by a cable.

A Datex 245P multifunction monitor (Datex Instrumentarium Oy, Helsinki, Finland) (for ECG, non-invasive blood pressure, pulse oximeter, 2 invasive pressures, temperature, and end-tidal and inspired oxygen, carbon dioxide, and nitrous oxide) is in clinical use in our operating room. The digital data output from the monitor was connected to an IBM AT-compatible computer which was running the Datex "DAISY" (Dedicated Anesthesia Information SYstem) program, version 1.00. This program is designed to function as a network interface for monitors, but it also permits a user-configurable display of the numerical data for a single monitor. A custom-prepared screen of the digital data was developed for display on the Private Eye.

At least two anesthesia personnel were present while the device was being tested, to assure adequate monitoring for patient care from the regular display screen of the monitor. Anesthesia department personnel were invited to come to the operating room to try out the Private Eye display. These users completed a questionnaire in regard to their experience.

Results. Eleven people tried the Private Eye display during the limited time that it was available. Most users required less than 15 minutes to adapt to the display. One common complaint was that the connection cable was too short to permit easy movement around the anesthesia work area. (A cable extension will be available soon.)

Of the 11 users, 6 (55%) agreed that it was comfortable to wear. Users were sharply divided on the ease of interpretation of the test display screen. Only 4 of the 11 users (36%) felt that it was easy to look at the display at the same time as something else. Five users (45%) felt that the vibration of the display was annoying.

Nine of the 11 users stated that they would like to use a display like this again, if it could duplicate the numbers and waveforms of the standard monitor screen.

Discussion. We have presented a clinical evaluation of this heads-up display in the operating room. With practice, some users of the device can see both the anesthesia work area and the display simultaneously. (An analogy would be a television screen with numbers superimposed on the picture.) It should be noted that the two users who stated that they would not like to use the device again had expressed strong negative feelings about the device before they tried it. An improved data layout and inclusion of waveforms would make the device more attractive. A successful display would allow this device to provide a continuously-visible display of relevant patient data, even when the anesthesiologist is devoting part of his or her attention to other tasks.

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TITLE: LOCALIZED RADIANT HEAT RESTORES THE OXYGEN CONSUMPTION OF POSTANESTHESIA SHIVERING TO NORMAL

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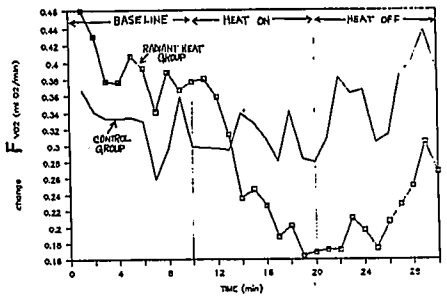
Postanesthesia shivering (PAS) occurs in 6% of postoperative patients. Muscular activity and increased cardiac output associated with PAS increases oxygen consumption (VO_2) as much as 400%. PAS can be harmful in patients with ischemic heart disease.

We believe that PAS is caused by a reception of cold by thermoreceptors of the skin, transmission of this cold information to the thermoregulatory apparatus in the hypothalmus, and reflex initiation of thermogenic shivering. PAS can be stopped by warming the skin which blocks the afferent limb of this reflex. This study evaluates the effect of the treatment of PAS with radiant heat on the elevated VO_2.

After IRB approval, nineteen patients who were overtly shivering volunteered for the study. All were healthy females recovering from Cesarean section or tubal ligation performed under epidural or spinal anesthesia. PAS was confirmed by pectoral electromyography; VO_2 was measured with the Deltatrac from Sensor Medics, Anaheim, Ca. The patients were randomly assigned to one of two treatment groups: radiant heat and control. The two groups were statistically similar in age, weight, height, type of anesthetic, temperature on arrival (35.3^{o}) and temperature at the end of the study (36.1^{o}). The radiant heat group was treated with a servocontrolled lamp consisting of six infrared bulbs. PAS ceased in 4 minutes and VO_2 was reduced to near normal levels. The lamp was turned off after 10 minutes, after which the VO_2 increased in excess of the gain in temperature but not to the degree seen during overt shivering. Patients in the control group continued to shiver and to exhibit elevated VO_2 throughout the 30 minutes of observation.



We conclude that PAS can be terminated by warming the skin with localized radiant heat and that the VO_2 decreases to a near normal level as the muscular activity ceases.