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Report of the Fourth International Symposium on Computing in Anesthesia and Intensive Care, September 2–6, 1986

Dwayne R. Westenskow
Department of Anesthesiology, University of Utah, Salt Lake City, UT 84132, USA

The fourth meeting on computing in anesthesia and intensive care was held in Rotterdam. This symposium was unusual because of extensive interaction between instrument manufacturers and researchers. Twelve major medical equipment companies were represented by their presidents or upper level management; their participation along with clinicians and researchers was a very significant part of the program.

Interchange between manufacturers and scientists peaked during a half day industrial panel. Scientists encouraged the manufacturers to come and visit to hear of their need for new equipment, equipment which would meet real clinical needs. Scientists stated that often newly introduced products are simple cosmetic improvements over existing devices. Clinicians want to help industry develop new devices which are truly innovative.

Equipment manufacturers expressed their interest in standards, but admitted that the medical industry hasn't done well in supporting standardization. Some expressed the fear that standardization would be detrimental to innovation. It is, however, in the best interest of industry to standardize. Definitons for units of measure, preferred display format, etc. would allow instruments to communicate better with each other and the whole industry would progress faster. The medical information bus was discussed in detail; attendees learned of the aim to established standard connectors on medical equipment, standard syntax, units of measure, alarms, and error recovery. Those engineers developing automated anesthesia records and hospital information systems were particularly pleased to hear of industry's interest in standardizing communication between medical instruments.

The manufacturing companies each gave $1^1/_2$ hour tutorials and several presentations. Products were discussed in detail, often with a design engineer and marketing manager. Industrial representatives described the design process of computer-based products, from the conception of the idea, through final testing. For example, one company discussed why they put a computer in a ventilator. The computer significantly improved the reliability over older analog circuits, reducing the number of service calls and the amount of time required per service call. By automatically charting data, respiratory therapists reduced took their 17 minutes per patient visit to only 5 minutes per visit. Computers in ventilators result in labor savings, improve safety and easier serviceability. Computers in other medical devices enhance decision support, simplify the human interface, provide access for closed-loop control, perform automatic calibration, and enhance stability.

Some of the highlights of scientific presentations were:

1. A Chem-FET pH sensor mounted on the tip of a 6 French catheter for continous intra-arterial pH monitoring with drift less than 0.1 pH units per 24 hrs.
2. An adaptive filter to remove 80% of the artifact from a noninvasive respiratory monitor.
3. A closed-loop controller which continuously monitors intra-arterial serum potassium concentration to control the potassium concentration by the infusion of potassium or insulin.
4. A system measuring FRC with sulfurhexafluride to find optimum PEEP for ventilator dependent patients.

5. An impedence cardiac output monitor to give accurate, noninvasive cardiac output, except during severe tachycardia.
6. A study showing that analgesia given via a patient control anesthesia device causes less respiratory depression than analgesia given by traditional means.
7. A study showing a computer provides better control of systolic blood pressure with sodium nitroprusside infusion than a group of trained nurses.
8. A study reporting that a computer infusing vecuronium controls neuromuscular blockade with less variability than manual control.
9. A clinical report using the frontal lobe EMG to identify inadequate levels of anesthesia.
10. A study concluding that the end inspiratory pause improves gas exchange because of decreased airway dead space.
11. A physiology study showing that the phase III slope of the CO_2 waveform during COPD results from reverse diffusion at the alveolar level.

Eleven papers presented automatic anesthesia charting systems describing many approaches to data presentation, data entry and user interaction. Each research group developed their own system without much apparent interaction with other developers and tremendous duplication of effort. One point was common to all: the automated anesthesia record is valuable.

In Nijmegen researchers kept two simultaneous records in the the operating room, one was kept manually in the usual manner, the second was kept automatically by a computerized record keeping system. At the end of an anesthetic case more than 80% of the data was missing from the manual record. There was a significant disparity between those values recorded manually and those recorded automatically, particularly for diastolic pressure, oxygen concentration and end tidal CO_2 concentration. The automated system significantly increased the amount of data on the record and improved the accuracy of the recorded data.

Data entry for the anesthesia record systems are very different. Data for procedures and drugs is entered through a touch screen, a full keyboard, a dedicated keyboard, or a barcode reader. Most systems are menu-driven. A new user learns to use the system after about 30 minutes of training. One system has no interaction with the user; all alarm limits were fixed. Blood pressure, heart rate, oxygen saturation and temperature are usually entered automatically through an A/D converter or digital communication port.

Although anesthesia record systems fill a clinical need, more development work is required. Little is now being done to identify artifacts to remove bad data from the automated record. More effort is needed on automatic acquisition of data; perhaps the medical information bus, with standards for communication, will enhance the automatic aquisition of data. Drug entry continues to be a problem: a barcode reader was reported to provide automatic entry of the drug name but the drug dose still has to be entered manually. Once the record keeping system contains valid data, acquired automatically, work can progress on smart or intelligent alarms.

Seven papers described hospital information systems. One system has cost to benefit ratio of 1:4. Successful examples of hospital information subsystems include:

1. A pharmacy package to warn of dangerous drug-drug interactions,
2. An infectious disease package which listing hospital patients with suspected infection,
3. A respiratory therapy package which increased productivity very significantly, and
4. A management program for staff and resources in the ICU based on automatic TISS score calculations.

Our thanks goes to Omar Prakash, M.D., symposium chairman, for organizing a full $4^1/_2$ day program of lectures, workshops, scientific presentations, posters and industrial tutorials. He and his staff made excellent arrangements for the physical facilities and social program. More information about the program and many of the abstracts are found in the International Journal of Clinical Monitoring Vol. 3, No. 1 1986. Other abstracts will be printed in the next issue of the Journal.