INTERFACE

SOCIETY FOR TECHNOLOGY IN ANESTHESIA

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STA: A BRIEF HISTORY

The importance of technology to clinical practice has been the impetus for the emergence of the STA. This relationship was described in the first official announcement of STA.

"Technology and patient safety are inexorably intertwined... We therefore increasingly depend on technology to help us, hopefully in the form of better anesthesia machines, ventilators, and monitors. But using all of these new and complex devices has not been easy. Most clinicians have not been trained to deal with technology, and most engineers and technicians have not been trained to deal with clinicians. The need for communication and education among those interested in medical technology is real." (JCM 5:148,1989)

WHAT'S IN A NAME ?

Everything! That is why the Board of Directors has chosen to call the STA newsletter INTERFACE. This name reflects the primary goal of the publication —to facilitate communication among a large group of individuals with overlapping interests in the area of medical technology.

Special thanks to Leslie E. Soper (Las Vegas, NV), Colleen Olhausen (Hartley, IA), Bradford E. Margulies (Haddonfield, NJ), Douglas Brown (Madison, WI), Frank Block, (Columbus, OH) and N. Ty Smith (San Diego, CA) for your catchy contributions to the name contest.

P.S. The "Mark Twain" who penned the winning entry prefers to remain anonymous and has donated the free membership to a needy colleague.

The Beginning

Prior to the formal organization of STA, in the late 70's, a small group of anesthesiologists perceived that education in technology needed to be more accessible to clinicians. They encouraged the ASA to develop workshops, panels and scientific presentations on technology for the annual meeting. In addition, an ASA Subcommittee on Equipment, Monitoring, and Engineering Technology was formed. In a short time, the technology section of the ASA annual meeting has grown to receive among the greatest number of abstracts annually.

The next step that paved the way for the formation of STA was the publication of a journal devoted to technology in clinical medicine. The Journal of Clinical Monitoring has since made it possible to formalize and archive the communication among those interested in medical technology. A less formal, yet structured, means of communication was still needed. Hence STA.

STA Goals Defined

A planning meeting was held at the ASA Meeting in San Francisco, October, 1988. The 50 people who attended the 6:00 AM meeting agreed upon the need for a technology society. The enthusiasm was so overwhelming that an organizational structure, including officers and a board of directors, was formalized at that first meeting. It was also decided that the society's relationship with the ASA would be one of mutual assistance and consultation. Those present at the meeting decided the goals of STA should be to (l) Have a clinical orientation, (2) Develop an international visibility (3) Encourage membership by all interested parties, (4) Have broad interests but a narrow name, and (5) Welcome clinically, technically, and industrially oriented members. At a subsequent meeting the Board of Directors agreed upon several benefits to membership in STA in addition to the opportunity to communicate with others interested in technology. These benefits included a subscription to the Journal of Clinical Monitoring, access to the JCM Readers Group Bulletin Board, a newsletter, and the sponsorship of meetings.

> ■ *"The interests of STA are diverse including all of the subspecialties of anesthesia and critical care, as well as the broader field of medical technology."*

A major impetus to STA came when a private foundation realized the importance of STA's mission and donated a very generous grant. This grant allowed STA to proceed and move forward much more rapidly than would otherwise have been possible.

ASA Meeting 1989

At the 1989 ASA Meeting in New Orleans a charter member meeting was held. The attendance was overwhelming; extra tables and extra food had to be commandeered at the last moment. STA also established a presence within the ASA by sponsoring a breakfast panel. The theme was a debate on who can take credit for the increase in patient safety: the clinician, the educator, the monitors, the APSF, the standards makers, the lawyers, the insurance companies, the researchers, or the new anesthetic agents. The panel was a success thanks to the stellar group of panelists.

The interests of STA are diverse including all of the subspecialties of anesthesia and critical care, as well as the broader field of medical technology. Accordingly, STA has been working on forming liaisons with other societies and special interest groups.

The rapid growth of STA is a testament to the vision of that small group of anesthesiologists who initiated the society. Future directions will be dictated by the desires of the membership and promise to be exciting and fruitful.

The Devil's Advocate

This column is intended to provide a springboard for lively discussion on issues and controversies relating to the application of technology to the practice of medicine. Opinions expressed by contributors to this column should not be construed as reflecting the views of the column editor, the STA Board of Directors, nor of the organization's membership. On the contrary, the opinions expressed are intended to be challenging and provocative, and should stimulate vigorous, reasoned correspondence. To preserve the uninhibited character of the column, the editor reserves the right to maintain the anonymity of contributors if requested. Correspondence and manuscript contributions should be directed to the *Editor, **The Devil's Advocate**, The Society for Technology in Anesthesia, PO Box 382, Hastings, MI 49058.*

How to Solve the Alarms Problem: *Think Japanese!*

Whenever users and developers of patient monitoring technology gather to discuss the problem of alarms, the users begin talking about futuristic solutions like "Heads Up Displays" and the developers say "Just tell us what you want and we will do it!" Such was the case at the recent STA-sponsored dinner during which a number of speakers addressed the alarms question. These discussions are intellectually stimulating, but make little progress towards solving the problems. I suggest that the development of useful alarms is entirely possible, but not without a structured approach to the problem and long term sponsored research.

The alarms problem can be solved with a three-part approach to research: 1) Detection of artifact in monitored signals, 2) Definition of appropriate alarm algorithms and 3) Optimizing the method of displaying alarm information.

Detection of artifact is the fundamental step which must be taken before meaningful alarm technology can be implemented. Anyone with an interest in monitoring technology is well aware of the frequency of artifact in monitored signals and the impact of these artifacts on false alarms. Even the most sophisticated alarm algorithms will be useless if the data they act upon are erroneous.

Definitions of appropriate alarm algorithms has yet to be addressed in a meaningful fashion. At present, alarms are tailored to the signals we can monitor rather than to the clinical context of an untoward event. For example, the low heart rate alarm frequently sounds in the healthy patient under anesthesia, but is never linked to the measurement of blood pressure to determine whether the bradycardia is significant. The ideal alarm algorithm would notify the clinician of an impending problem rather than the problem that already exists. At present, narrowing alarm limits may provide an earlier warning, but in reality only increases the frequency of nuisance alarms. Research efforts currently underway to develop equipment-related contextual alarms (eg. automated diagnosis of breathing circuit faults), begin to address the problem, but much work is needed in the area of patient-related alarms.

The display of alarms has received a great deal of attention, but is not very important without solutions to the artifact and algorithm issues. Whether the alarm is displayed visually or audibly is irrelevant if the alarm is uninformative. Displays should serve two purposes: 1) Draw attention to an important situation and 2) Facilitate rapid diagnosis and corrective action. Fortunately, industries such as aviation have studied this problem extensively, and much can be learned from their efforts.

So how can thinking Japanese help? The high definition television (HDTV) and fifth generation computing projects in Japan are examples of cooperation among competing companies where resources have been pooled to sponsor the necessary long term research. This same effort is needed to

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This is a response to last issue's "*Agent ID: Another Advertising Gimmick*"

AGENT SPECIFIC ANALYSIS: *An Overdue Patient Safety Tool*

Brian G. McAlary
Associate Medical Director for Anesthesia
Maryland Institute for Emergency Medical Services Systems, Baltimore, MD

In the previous Devil's Advocate column, readers were exposed to the frankly erroneous view of the article's unnamed author that the long overdue capability of anesthetic agent monitors to provide agent specific analysis was little more than an "advertising gimmick."

The article implies that, except for methoxyflurane being inadvertently placed in a Halothane vaporizer, there is no injury associated with administering the incorrect agent. This invalid assertion is given the aura of reality by the misguided logic that "if I don't know of it happening, it hasn't happened."

If this assertion were valid, it could be argued that a clinician would be permitted to add whatever agent they wished to any vaporizer with nothing more than routine patient monitoring as a guide. When experienced clinicians are systematically inter-

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INTERFACE is the official newsletter of the Society for Technology in Anesthesia. The newsletter is published quarterly and mailed directly to the membership of the society. Copies are also distributed to companion societies in Europe and Japan. The editor invites suggestions, contributions and commentary about published items. Please send all correspondence to:

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PERSPECTIVES ON TECHNOLOGY

TOPIC: ECHOCARDIOGRAPHY

■ *"The challenge for industry is to balance product development efforts for current users against the allocation of resources to address the new expectations and needs of the anesthesiologist."*

The Industrial Perspective

Tabetha Watkins-Ivy
Cardiology Market Development Manager
Advanced Technology Laboratories
Bothell, WA

Echocardiography has undergone tremendous growth as a diagnostic modality since the first M-mode systems of the 1960's. Today, two-dimensional imaging, pulsed and continuous wave Doppler and color flow imaging are standards for noninvasive assessment of cardiac structures and hemodynamics. The growth of this technology has stirred interest in applying echocardiography in new clinical areas, among these, the operating room.

Echocardiography in the OR

Two developments have enabled echocardiography to be readily utilized in the operating room. Transesophageal echocardiography (TEE) uses an ultrasound transducer mounted on the tip of a gastroscope allowing placement of the probe within the esophagus to facilitate uninterrupted imaging of the heart without contamination of the surgical field. The other innovation is in digital framegrabbing technology, which allows split or quad screen display of the heart, typically the left ventricle. Whether monitoring LV function or evaluating a surgical procedure, split displays allow for direct comparison of images. In addition, since TEE systems are becoming more prevalent in the operating room, some manufacturers of anesthesia monitoring equipment are designing monitors that can incorporate the display of cardiac images directly on the anesthesia monitor along with the patient's physiologic parameters.

Companies manufacturing ultrasound equipment view the new applications in the operating room as an opportunity to expand the market for ultrasound. The challenge for industry is to balance product development efforts that meet the needs of current users against the allocation of resources to address the new expectations and needs of the anesthesiologist.

In some anesthesiologists' opinion, the ultimate echocardiographic monitoring system is a small box that has a digital display of volume or ejection fraction and an alarm alerting changes over time and that costs less than $30,000! While, ultimately, technology may allow us to design such a system, there are many steps along the development path, and many questions that must be answered, before resources are applied to bring such a product to the market.

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■ *"Although TEE has found application, if it is to be more widely used the instrumentation will need to become more compact, the amount of time required reduced and the display formatted to obtain the necessary information quickly."*

The Clinical Perspective

Kenneth Raessler, MD
Staff Anesthesiologist
Maine Medical Center
Portland, Maine

The combination of ultrasonic two-dimensional imaging and Doppler technology has expanded the role of echocardiography in the diagnosis and management of patients with heart disease. Unfortunately, during precordial studies, bone, air and fat block ultrasound transmission resulting in limited image quality, particularly in patients with obesity, emphysema and/or structural abnormalities of the chest. Limitations to the use of echocardiography in the operating room include the need to maintain a sterile field and the inability to change patient position to optimize the image.

TEE - An Exciting Tool

Transesophageal echocardiography (TEE) is performed using a two-dimensional ultrasound transducer mounted at the end of a conventional gastroscope which is positioned in the esophagus and upper stomach. This approach overcomes the limitations of precordial echocardiography since the ultrasonic beam passes easily through the esophagus and pericardium and the sterile field is maintained. Both cross section and long axis views of the heart can be readily obtained. The transducer can then be left in the esophagus and used to monitor the heart throughout the surgical procedure. TEE therefore, provides anesthesiologists an opportunity to utilize continuous echocardiography throughout a surgical procedure.

TEE can be used intraoperatively to assess the adequacy of myocardial perfusion by observing changes in regional and global myocardial function and wall thickness. At least one report indicates that TEE is more sensitive for the detection of intraoperative myocardial ischemia than electrocardiography. TEE can also be used to assess the adequacy of the repair of intracardiac shunts and valvular lesions, to detect intracardiac air and to measure ventricular volumes. The recent addition of Doppler color flow mapping, has improved the ease with which regurgitant lesions may be detected and quantitated.

The risks of TEE are small. It is contraindicated in patients with a history of swallowing complaints or esophageal disease. There have also been a few reports of temporary vocal cord paralysis and esophageal trauma following prolonged intraoperative studies.

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The Industrial Perspective

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Improvements

To achieve this advanced capability, new algorithms for automatic edge detection must be perfected. Using sophisticated computer analysis, the echocardiography system should ultimately be able to automatically outline the LV wall to track in real time systolic and diastolic wall motion and volume measurements. Advances in TEE probe design eventually will allow multi-plane imaging, providing unlimited flexibility in aligning the two-dimensional imaging plane to visualize the desired cardiac structure or area of the left ventricle for volumetric assessment. Image quality improvements are contributing to exciting research in this area. Short of these future product goals, there are applications using today's equipment that are piquing the interests of researchers in anesthesia and echocardiography. Industry is supporting centers establishing today's applications in an effort to gain additional insight into anesthesiologists' needs and to direct future product development efforts to meet those needs.

Echocardiography is currently being used in the OR for two purposes; assessment and guidance of cardiac surgical procedures and monitoring LV function and ischemia detection during cardiac or high risk surgery. The use of echocardiography for guidance and assessment of cardiac surgery has achieved wider acceptance among surgeons and anesthesiologists than monitoring. To fully establish echocardiography as an accepted operating room monitoring tool the challenge facing industry and researchers is to determine whether the information is sufficiently reliable to warrant changes in patient management. Once this question is fully understood then industry can apply appropriate resources to refine today's technologies and direct future engineering design efforts to optimize the equipment for use by the anesthesiologist. Industry and academia alike must work together to address the educational barriers that we both will face in order to achieve this goal.

Practical Issues

Training the anesthesiologist in the acquisition and interpretation of the two dimensional images is fundamental to using the capability of echocardiography to its fullest. Issues regarding proper training protocols, the involvement of cardiologists, reimbursement guidelines, and various other political issues within a hospital, must all be addressed by the anesthesiology community before industry will be able to react to the growing interest by adding to the capabilities already available.

Improved image resolution and quality, optimization of image acquisition and display formats, improved analysis of segmental wall motion and volume changes and automated quantitative analysis are but a few of the technical solutions required to advance echocardiography as a diagnostic tool for physicians. Ultimately these requirements should make echocardiography not only an accepted technology for cardiac surgery but a useful monitoring tool for the anesthesiologist.

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The User's Perspective

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Limitations

Despite the valuable information that can be obtained, TEE/Doppler remains a difficult technique to master. Since the transducer replaces the fiberoptic bundles of the gastroscope it must be passed into the esophagus either blindly or under direct vision with a laryngoscope. The gastroscope in which the transducer is mounted is quite large and the potential for esophageal injury, particularly when the procedure is prolonged, is real. The echocardiography machine is a large piece of equipment that requires repositioning of the anesthesia machine and other monitoring equipment. Obtaining high quality images requires constant attention to transducer position and frequent adjustment of the equipment by a technician or the anesthesiologist. When TEE is used to detect intraoperative myocardial ischemia by following serial changes in myocardial wall thickness and contractility, even more skill and time on the part of the observer is required. Because of these limitations, at our institution, a cardiologist and technician are present during the examination and TEE/Doppler is limited to the assessment of the adequacy of the repair of valvular defects and intracardiac shunts as well as the removal of intracardiac tumors. We have not attempted to monitor regional wall motion abnormalities in patients undergoing non-cardiac surgery to detect myocardial ischemia.

The Future

TEE/Doppler is an exciting new technique used for intraoperative diagnosis and monitoring. Unfortunately, the instrumentation is bulky and expensive. Considerable operator time and expertise is required to consistently obtain high quality images and reliable data. Although TEE has found application in cardiac surgery, if it is to be more widely used in other areas for monitoring left ventricular function and regional wall motion abnormalities, the instrumentation will need to become more compact, the amount of time required of the operator reduced and the display formatted in such a way that the operator can obtain the necessary information quickly. Until these goals are met, TEE/Doppler will probably not become a "routine" monitor.

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ASA Panel Highlights Technology in QA

John H. Eichhorn, M.D.
Associate Professor of Anesthesia
Harvard Medical School
Beth Israel Hospital, Boston

"How Can Technology Help Me With Quality Assurance?" was the topic of the annual Society for Technology in Anesthesia Breakfast Panel at the American Society of Anesthesiologists' Annual Meeting in Las Vegas October 24.

One hundred twenty early risers attended the panel which was moderated by John H. Eichhorn, M.D. from Boston, MA. Other panel participants were Jerry A. Cohen, MD from the University of Florida, Gainesville, FL, and Terry S. Vitez, M.D. then from the Texas Heart Institute, Houston, TX.

Dr. Eichhorn opened with a discussion of the terminology and methodology of QA defining indicators, criteria, generic screening and many other components of the new "qual-speak" language. The prospect of having an interface between auto-

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UPCOMING EVENTS

♦ **APSF Meeting:**
Anesthesia Patient Safety Foundation Meeting. "Problems and Promises, A Dialogue between Industry and Users." Immediately precedes STA '91.
January 16-17, 1990
Grosvenor Resort Hotel, Orlando, Florida.
Contact:

Ms. Gerri Kuzava
PO Box 382
Hastings, MI 49058
Tel (616) 945-5110, or
1-800-552-9229

♦ **STA '91**:
First annual meeting of the Society for Technology in Anesthesia.
January 18-20, 1990
Grosvenor Resort Hotel, Orlando, Florida.
Contact:

Ms. Gerri Kuzava
PO Box 382
Hastings, MI 49058
Tel (616) 945-5110, or
1-800-552-9229

♦ **Sixth ISCAIC Meeting**:
Sixth International Symposium on Computing in Anesthesia and Intensive Care.
April 15-19, 1990
Hamamatsu, Japan.
Contact:

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ESCTAIC HOLDS FIRST MEETING

Alastair Lack
SALISBURY HOSPITAL, SALISBURY, WILTSHIRE, UK

The first Congress of the European Society for Computing and Technology in Anaesthesia and Intensive Care was held from the 24th to the 27th October 1990 at Goldegg Castle near Salzburg, in Austria.

The Society was formed early last year by a group of individuals who had been invited to speak at a session put on by the European Academy of Anaesthesia at Sarlat in September 1988. The participants agreed that there was a need for an organization to bring together representatives from the European community to coordinate and inform each other of their activities in computing and technology. The result of this was a meeting at Goldegg, with members from 23 European countries and Ty Smith from the United States getting together for three very pleasant days of intense discussion, liaison and negotiation. As far as we can tell, Luxembourg, Monaco, Iceland and Portugal were the only countries not represented amongst a group of 230 interested parties.

■ *"...the overwhelming wish was that Europe should draw together and that international barriers to cooperation be removed."*

The principal purpose of the meeting was to communicate, and therefore everybody who wanted to was given an opportunity to let us know what their fields of work and interest were. This meant that we had some 60 papers to hear and discuss on topics ranging from "Satellite Communication of Intensive Care Data Across Russia", to "Micro-Computer Control of Propofol Infusion", and every other kind of teaching, record keeping, technological and data management topic that you can imagine.

The result of this approach was that a large number of people who had been working in isolation, often behind the Iron Curtain, for the first time were able to share their ideas on an international scale. A great deal of the extra-curricular discussion, and indeed some of the papers, related to the needs of Europe to agree on language, communications, protocols, datasets and so on. If just these can be agreed upon, great steps forward will have been made. In fact, English was chosen as the common language and valiant efforts were made by many who had never heard a native speak it before. It was quite clear that the overwhelming wish on everybody's part was that Europe should draw together and that international barriers to cooperation be removed. This new society has a great deal going for it and will undoubtedly have an important impact on the development of medical technology.

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STA to Sponsor Annual Dinner at the ASA Meeting

The STA has sponsored dinners at the last two ASA meetings. Both dinners had a theme with invited experts and much time for informal discussion. The overwhelming success of these two dinners has convinced the STA leadership that this annual event should be continued. A poll of the audience indicated that the best night for this event is the night before the scientific sessions at the ASA meeting. This will allow those attending the refresher courses held in the first two days of the meeting to stay for the dinner. In addition, those people coming only for the scientific sessions could arrive the night before and enjoy a meal, good company and lively discussion.

See you at next year's dinner!

STA Dinner:

A Resounding Success!

The STA sponsored an entertaining dinner meeting at the recent ASA meeting in Las Vegas. The topic was "Alarm Sounds: What Can We Do About Them?" A number of experts presented informative talks that were followed by much lively discussion.

Sound, Silence and Harmony

Christopher Goodrich (Ohmeda) began the formal presentation with a demonstration of the Patterson sounds - a series of unique tones that have been proposed as a standard for physiologic alarms. Each sound was proposed to relate to a particular physiologic parameter. Although the proposed scheme is quite extensive, the utility of such a large number of non-intuitive alarm sounds is questionable.

Carl Pantiskas (SpaceLabs) described the scope of the problem of implementing alarm sounds. He expressed some frustration over the inability to determine not only the best tone for the alarms but, more importantly, the exact clinical needs. Medical equipment manufacturers provide equipment for many different settings - PACU, Operating Room, ICU, Emergency Room - all of which have different needs that remain to be clearly defined.

> ■ *"Although it was recognized that alarms must get attention and transfer information, the problem of designing appropriate alarm technology remains ill-defined."*

Dwayne Westenskow (University of Utah) emphasized the "Silence is Golden" approach to alarms. Recent studies document the prevalence of false negative alarms which limit the utility of alarms significantly. Advances in integration of monitoring, setting appropriate limits and diagnostic alarms are needed to reduce the "noise" generated by current alarms.

Dan Pettus (Diatek) used the extensive experience of his company with interfacing to a large variety of equipment to emphasize the importance of standardization. Integration is fundamental to the development of smart alarms and will require standardization of a means to acquire signals from different equipment. Pettus also alluded to the potential utility of voice enunciation of alarms as an alternative to non-specific alarm sounds.

Sandy Eames (Datascope) examined some approaches to alarm technology outside the operating room, namely in the electric power and airline industries. Utility companies maintain central control stations that service large geographic areas. The problem is that over 100,000 alarms are possible, and a single fault may generate a burst of alarms that confuses the operator and impairs problem solving. Their approach has been to develop a visual schematic to aid in isolating the problem and to generate diagnostic messages. A new system designed by Boeing is a smart alarm system that asks three questions of each alarm: 1) What action is required? 2) Who should take the action? and 3) Which phase of flight is it? Alarms are then prioritized and focused to the important individual(s). Eames used these examples to emphasize what we can learn from other industries with similar alarm problems.

Michael Quinn (UCSD) asserted that current alarm technology may have a hidden agenda. The natural response to alarms is to "make it stop." Alarms therefore transfer responsibility to the user for managing important events rather than aiding in diagnosis and management of clinical problems.

Frank Block (Ohio State University) used harmony as the theme for a fascinating presentation of alternative alarm sounds. Dr. Block had the audience listen to a series of well known songs that could be used to identify particular alarm conditions. For example, a fragment from "I Lost My Heart in San Francisco" was suggested as the means to identify a cardiovascular alarm. Once a song was associated with a particular alarm parameter it was easy for the audience to recognize the indicated "alarm." The exercise emphasized the importance of making alarm sounds intuitive so that they are easily identified. People can recognize many different songs, but only a limited number of beeps and blips.

Lively Discussion

The discussion that followed the presentations was both spirited and interesting. There was much debate regarding the various alternatives to display technology - visual and audible including sound and voice. Although it was recognized that alarms must get attention and transfer information, the problem of designing appropriate alarm technology remains ill-defined. There was no firm consensus regarding what we want to alarm and how to attach display technology. Although standards may be helpful, concern was raised over the tendency for a standard to freeze change and that any standard should continue to foster evolution of technology.

It is a good bet that the 110 people who attended this event will be back next year at the STA dinner to be held at the ASA meeting in San Francisco. And joining them, even more guests as the word gets out that this is one dinner not to be missed!

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ISCAIC PROGRAM HIGHLIGHTS (Preliminary)

Symposia

- **Topic: Patient Safety, "Minimal Requirements and Advanced Techniques in Monitoring"**

Minimal Requirements
J. Cooper, MD
A.A. Spence, MD

Respiratory Oxygen Monitoring
Kai Linko, MD

CNS Monitoring
N. Ty Smith, MD

Anesthetic Gas Monitoring
J. H. Philip ME, MD

- **Topic: What's New in the World**

What's New in the United States

Anesthetic Machine Design
D. Westenskow, PhD

Anesthesia Record Displays and Alarms
A. Ream MD

Computer-based Decision Assistance in Intensive Care A. Seiver, MD

What's New in Europe

Computerized Infusion Systems
G.N.C. Kenny, MD

Patient Data Managing Systems
W.J. Friesdorf MD

Minimum Data Sets for Anaesthesia and Intensive Care A. Lack, MD

What's New in China N. Deng MD
What's New in Australia TBA

- **Topic: Simulation and Modeling** TBA

SPECIAL LECTURES

- **Topic: Oximetry** J.W. Severinghaus, MD
- **Topic: Information Management systems** N. Ty Smith, MD

AGENT SPECIFIC ANALYSIS:

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viewed regarding medication errors, a variety of problems including unexplained cardiovascular depression have been related to the administration of the incorrect inhalation agent. In the case of one major teaching institution, the use of agent specific analysis has brought to light an unexpectedly high incidence of otherwise unrecognized volatile agent administration errors including wrong agent and simultaneous multiple agent administration. In each case, however, the use of multiple agent analysis permitted early intervention without any adverse patient outcome. Hopefully, we are well past the mind set that in order for an error to be of consequence, a patient must be killed. Given the relatively low mortality directly attributed to anesthesia, emphasis has been wisely placed on the reduction of preventable morbidity. Is it necessary for us to be reminded of the many real pharmacologic differences in the volatile agents? Would most informed clinicians elect to preferentially administer halothane to a patient with moderate left ventricular compromise, elevated intracranial pressure, or a malignant ventricular dysrhythmia?

In today's era of ambulatory care, even in the absence of an absolute overdose, prolonged emergence alone is at best a clearly undesirable feature, and may in fact invite postoperative hypoventilation or inadequate airway protection.

The assumption that errors related to administration of the incorrect agent or agents is not a significant problem also implies that all such errors are and will be promptly detected, and appropriate responses consistently made. This is clearly not supported by the analysis of closed liability claims which repeatedly points to transient lapses of vigilance resulting in patient injury. If such vigilance was always possible, we could also save money and time by eliminating the proliferation of often irritating alarms.

The final argument offered was related to the possible future release of Desflurane and the alleged dilemma that such an agent would pose for agent specific analysis. The primary fallacy in this position relates to the fact that no one can promise us if and when this worthy alternative will reach the shelf. Nor can we predict that agents such as Halothane and Enflurane will still be in significant use when Desflurane or Sevoflurane appear. Secondly, the technology that makes agent specific analysis possible can be readily adapted to permit new agent display. In the interim, we have a clearly identified problem of volatile agent administration errors that has fortunately been addressed by both more informed monitoring manufacturers and concerned clinicians.

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THE DEVIL'S ADVOCATE

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address the alarm question, since no single medical monitoring manufacturer is likely to commit the required resources. Profit margins are tight in the monitoring industry, the market is small and advances in alarm technology per se are not perceived as a means to increase market share. Nonetheless, due to the role of human error in anesthesia related morbidity/mortality, improvements in alarm technology will translate into improved patient care.

I am tired of hearing from industry "Tell us what you want and we will do it!" The problem is not that simple to solve - yet it IS solvable. There are a number of committed investigators who could make significant advances, but cannot obtain the long term commitment necessary to support an effective research effort.

I would propose that a research foundation be initiated by a consortium of interested parties where grant applications could be submitted in the three areas of alarms development outlined above. Investigators could then compete for funding that would continue for the time required to address these problems. The foundation should also be structured to provide engineering support so that time is not spent "re-inventing the wheel" such as developing computer interfaces to physiologic monitors.

I hope these English words do not fall on deaf ears. If they were written in Japanese, I suspect someone might listen.

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ASA PANEL HIGHLIGHTS TECHNOLOGY IN QA

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mated anesthesia record technology and a QA system was explored at length and it was concluded that this would vastly simplify QA data acquisition and also allow examination of clinical correlations in previously-impossible breadth and depth.

Dr. Cohen detailed the extensive anesthesia QA system developed at the University of Florida which uses a generic screening form completed by the anesthesia practitioners for each individual case. The data from the form is entered into a database by a secretary. Dr. Cohen emphasized the statistical and reporting power of the data base for developing QA assessments. Furthermore, building the data base with some flexibility allows for insertion and deletion of indicators as changing clinical patterns dictate.

Dr. Vitez outlined the model for "judging clinical competency" and explained the role of the computerized data base in this component of the QA process. He also discussed a common issue raised throughout all discussions of the interrelation of technology and clinical medicine - computerphobia on

> ■ *"A common issue is computerphobia on the part of the practitioner ... in retrospect, the evolution was relatively painless and extremely rewarding."*

the part of the practitioner. All three speakers made reference to experiences of transition from either frank fear or simple ignorance to relative computer literacy and how, especially in retrospect, the evolution was relatively painless and extremely rewarding.

Questions from the audience covered many topics, but the one of most interest was QA data capture. There seemed to be a reluctance to require anesthesia providers to complete a hand-written form. Dr. Cohen noted that it is true his secretary has to find some practitioners after the fact to complete the forms. Alternatives mentioned include computerized capture from sophisticated algorithms examining data obtained on automated anesthesia records, direct data base entry by practitioners (keyboard, touchscreen, or lightpen and bar code), or screening and data entry by a paid professional from anesthesia records that would be made scrupulously complete by the involved clinicians. There was general agreement that the issue of the best method for data capture was unresolved and likely to be a "hot topic" for some time to come.

Success of the Breakfast Panel was evident by the total consumption of available juice and pastry and several audience members stating they already were looking forward to next year's gathering.