EDITOR’S CHOICE:
The Best of the Anesthesia Patient Safety Foundation Newsletter 1986-2014
Learning Objectives:

After this presentation, the participant should be able to:

• Discuss the crisis in anesthesia that led to the establishment of the APSF.

• Cite three patient safety issues that the APSF Newsletter helped disseminate and how these issues were resolved.

• Discuss what features of the APSF make it unique among patient safety organizations.
"The Deep Sleep: 6,000 Will Die or Suffer Brain Damage."

ABC 20/20
April 22, 1982
Crisis Create Opportunity

Preventable Anesthesia Accidents

Poor Patient Outcomes

Poor PR Image

Professional Liability Crisis

Dedicated Individuals in Influential Positions Interested in Patient Safety
Ellison C. ("Jeep") Pierce, Jr, MD
• Pierce (1st ASA VP)
  • 1983 ASA creates Committee on Patient Safety and Risk Management
• Jeffrey B Cooper, PhD: Human Errors Research
  • Critical Incident Analysis
• Richard J Kitz, MD: Chair at MGH
  • Prof. T. Cecil Gray (England)
  • International Symposium on Preventable Anesthesia Mortality and Morbidity –1984
• Pierce (ASA Immed. Past President)
  • October 2, 1985 APSF articles of incorporation accepted by ASA
The APSF Executive Committee

September 30, 1985
First use of the term “Patient Safety” in a professional organization.
“Anesthesia mortality is everybody's problem. Most people will be exposed to the risk several times in their life. When a bad outcome occurs, it affects the”

patient
family
anesthetist
anesthetist's colleagues
manufacturer & designer of involved equipment
hospital administrator
professional liability company
viability of organization and healthcare system
federal government

Cooper JB and Pierce EC. For the Executive Committee
Vol. 1, No. 1, March 1986
Ellison C. “Jeep” Pierce

1985-2003

Robert K. Stoelting

2003-present

APSF Presidents
APSF Newsletter Editors

John Eichhorn, MD
1986-2002

Robert C Morell, MD
2002-present

Lorri A Lee, MD
2010-present
COMMUNICATION / DISSEMINATION

• Common Ground
  • Industry, CRNAs, MDs
  • Professional Liability, FDA, TJC
• Accessibility for Patient Safety Issues & Questions
  • *Letters to the Editor*
• ASA Patient Safety Issues
  • *Standards, Practice Parameters*
• Peer-Reviewed Literature for Patient Safety
• ASA Closed Claims Studies
  • *Increase Awareness of Registries*
Safety Foundation Organized
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Safety Foundation Organized

Is There Minimal Essential Monitoring??

APSF to Award Grants for Research In Patient Safety

Foreign Correspondence

From the Literature

Current Questions in Patient Safety

APSF Officers, Directors, and Committees

Closed Claims Study Seeks Data

ASA Adds to Videotape series on Patient Safety

Notes
1. Intraoperative Monitoring Standards

- Anesthesia mortality 1960s-1970s:
  - 1:2000 to 1:7000

- Recent 20/20 episode

- High professional liability premiums

- Dr. Pierce strong proponent of intraoperative monitoring standards
Guidelines for Patient Care in Anesthesiology

1) O2 analyzer with low conc alarm in circuit,
2) Low pressure alarm on ventilator when used
3) At least 2 of the following:
   a) intermittent or continuous BP monitoring,
   b) continuous ECG,
   c) precordial esophageal stethoscope
9 Harvard system hospitals from 1976 -1984
• 15 anesthesia-related deaths / accidents
• Most preventable - better monitoring and vigilance

Standards for Patient Monitoring During Anesthesia:
• Attending, Resident, or CRNA present at all times
• BP, HR every 5 min for all anesthetics
• ECG for all patients
• Continuous Monitoring of Ventilation / Circulation
• Circuit disconnect alarm, O2 analyzer
• Ability to measure temperature

JAMA 1986; 256(8):1017
Standards for Patient Monitoring During Anesthesia at Harvard Medical School

John H. Eichhorn, MD; Jeffrey B. Cooper, PhD; David J. Cullen, MD; Ward R. Maier, MD;
James H. Philip, MD; Robert G. Seeman, MD

As part of a major patient safety/risk management effort, the Department of Anaesthesia of Harvard Medical School, Boston, has devised specific, detailed, mandatory standards for minimal patient monitoring during anesthesia at its nine component teaching hospitals. Such standards have not previously existed, and resistance to the concept was anticipated but not seen. The standards are technically achievable in all settings and affordable in terms of effort and cost. Early detection of untoward trends or events during anesthesia will result in prevention or mitigation of patient injury; this, in turn, may also help counter the explosive increases in anesthesia-related malpractice actions, settlements, judgments, and insurance premiums. The committee process used is applicable to the promulgation of standards of practice for all medical specialties and any organized group of medical practitioners.

(JAMA 1986;256:1017-1020)
Is There Minimal Essential Monitoring?

We will search in vain for scientific evidence demonstrating that this or that convention will indeed improve the lot of our average patient… Ignoring such conventions will cause critics to ask whether applying those conventions could possibly hurt and whether they might not indeed help? And once we have to admit that they might, in fact, be helpful in reducing adverse incidents in anesthesia, we have taken the first step toward adopting them ourselves.

- J.S. Gravenstein, MD
We recently have witnessed an explosive growth in the technology of equipment available to us for the care of our patients. This has come at a time when cost containment in medical care has become of paramount concern. Many would hide behind the premise of cost containment in justifying why equipment should not be obtained to properly monitor our patients. On the other hand, we must be the patient’s advocate and not compromise safety.

**Minimal Requirements for Monitoring – 1986**
*Anesthesiology* June 1986; 64(6):840-841

**Jerome H. Modell, M.D.**
Professor and Chairman
Department of Anesthesiology
University of Florida College of Medicine
Gainesville, Florida 32610-0254
ASA Adopts Basic Monitoring Standards
Approved by the House of Delegates
October 21, 1986

STANDARD I
Qualified anesthesia personnel present in the room throughout all anesthetics
ASA Adopts Basic Monitoring Standards

STANDARD II
During all anesthetics, the patient's oxygenation, ventilation, circulation and temperature shall be continually evaluated.

- $\text{FiO}_2$ Analyzer, Low O$_2$ alarm, ventilator disconnect alarm
- BP and HR Q 5min
- Availability of temperature monitor
- Clinical: patient color, chest excursion, chest auscultation, proper position of OET, palpable pulse
- Encouraged: capnography and pulse oximetry
DEAR SIRS

(SAFETY INFORMATION RESPONSE SYSTEM)

Introduced Spring 2004

Michael Olympio, MD & Robert C Morell, MD

- Allows rapid communication and response
- Provides a win-win for clinicians and industry
- Encourages cooperative relationship
Misplaced Valve Poses Potential Hazard

Dear SIRS:

We have discovered what we believe to be an error in the assembly of 9 Datex-Ohmeda Aestiva anesthesia machines recently delivered and installed which, if not detected, has the potential to cause injury to anesthetized patients.

The problem is in the AGSS (active gas scavenging system) option which produces, when the evacuation hose becomes occluded, sustained airway pressures (PEEP) of up to 40 cm. This condition is exacerbated by high fresh gas flows and when mechanical ventilation is in use.

The AGSS is designed to have an opening in the bottom of a plastic receiver, providing relief of both positive and negative excess pressures. In what appears to be an assembly error, a negative pressure relief valve (similar to a circle system one-way valve) was installed in this opening (see photos 1 and 2). This provided relief of excess negative pressure (too much evacuation suction), but no positive pressure relief.

This valve is used appropriately in the passive system, but the passive system also has a positive pressure relief in the upper portion of the receiver unit. Our best explanation is that the receiver assembly is composed of a top and a bottom section. We were (possibly) delivered...
Without Valve (correct)  With Valve (incorrect)

Photo 1. Bottom view of the active scavenging reservoir without valve (correct configuration).

Photo 2. Bottom view of the active scavenging reservoir with valve in place (incorrect configuration).
Manufacturer Provides Prompt Response

(In Reply)

Dear SIRS:

Datex-Ohmeda would like to thank the APSF Newsletter for the opportunity to respond to the letter by Berry and Blanks.

The authors have correctly identified the root cause of the rising airway pressure encountered in some of their Aestiva anesthesia machines. There are two options for gas scavenging in the Aestiva. One is passive and the other, the option used by the authors, is an active system that uses vacuum to remove the scavenged gases from the patient circuit and from the ventilator drive system.

The AGSS units that were assembled incorrectly had a valve normally used for the passive systems installed in the base of the AGSS unit. The presence of this valve prevented excessive gases within the AGSS from escaping when the vacuum outflow was occluded, as described by the authors.

Datex-Ohmeda has identified the cause of the incorrect assembly and has instituted changes in the assembly process to avoid a repeat of this error. In addition, there is now an additional test of the AGSS to verify that all units have the correct valves in place. Datex-Ohmeda has also identified the entire population of AGSS units that may have been assembled incorrectly, has identified the location of the entire suspect population, and has begun an active Field Action to check the AGSS units, verify their proper manufacture and assure that any occlusion of the AGSS exhaust hoses will not produce a rise in the system airway pressure in the future.

Michael Mitton
Director of Clinical Affairs
Datex-Ohmeda, now a part of GE Medical Systems
Canister Fires Become A Hot Safety Concern

Carbon Dioxide Absorbent Desiccation Safety Conference Convened by APSF

There is increasing evidence that exposure of volatile anesthetics to desiccated carbon dioxide absorbents may result in exothermic reactions leading to fires in anesthetic breathing circuits and production of toxic products (e.g., carbon monoxide, compound A, methanol, formaldehyde). Although fires have only been reported in association with sevoflurane exposed to desiccated Baralyme® (Allied Healthcare/Chemtrin, withdrawn from the market), there is significant evidence that potentially toxic products can be produced upon exposure of volatile anesthetics to other desiccated absorbents containing strong bases, particularly potassium and sodium hydride. In some cases this may lead to sub-clinical carbon monoxide exposure.

In view of these continued anesthesia patient safety concerns, the Anesthesia Patient Safety Foundation invited medical experts and industry repre...
Dear SIRS

Common Gas Outlet Concern Leads to Corrective Action

Dear SIRS:

Dear SIRS (response):

APSF NEWSLETTER Summer 2010

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Dear SIRS

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Use?

APSF NEWSLETTER Winter 2008-2009

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Dear SIRS

Isoflurane Damages Apollo Water Trap

Dear SIRS:

Anesthesia personnel have come to rely heavily upon end-tidal carbon dioxide concentration to confirm correct endotracheal tube placement and adequate ventilation. We report a case of sudden loss of end-tidal carbon dioxide during a prone-positioned case due to a substantial leak in the breathing circuit caused by failure of the sidestream capnography measurement system. This failure was a result of a crack in the water trap for the gas analyzer on a Dräger Apollo anesthesia machine that occurred from accidental spillage of isoflurane.

The nitrous oxide was discontinued, and oxygen flow was turned to 10 L/min. A substantial leak was apparent on manual ventilation, and the capnogram tracing was absent, despite connection of the sampling tubing. The patient was switched from the anesthesia circuit to a self-inflating bag valve system. Despite apparent loss of end-tidal carbon dioxide, blood pressure and heart rate remained stable, and the pulse oximeter read 100% with a nominal plethysmogram. Anesthesia was maintained by increasing the remifentanil drip and intermittent boluses of propofol. Although no evidence of a change in the endotracheal tube was apparent clinically, the patient was brought in the room and the nursing team was made aware of the possible need for reintubation...
The Impact of Adverse Events on Patients and Providers
RESPIRATORY DEPRESSION AND POSTOPERATIVE OPIOIDS

Dangers of Postoperative Opioids

APSF Workshop and White Paper Address Prevention of Postoperative Respiratory Complications
A widespread program should be initiated to educate providers and patients about the risks of life-threatening respiratory depression associated with the postoperative use of parenteral opioid analgesics. Many clinicians, and the lay

Ramsay Sedation Assessment Scale

<table>
<thead>
<tr>
<th>Awake Levels:</th>
<th>Patient anxious or agitated or both 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patient cooperative, oriented and tranquil 2</td>
</tr>
<tr>
<td></td>
<td>Patient responds to commands only 3</td>
</tr>
<tr>
<td>Asleep Levels:</td>
<td>A brisk response to a light glabellar tap 4</td>
</tr>
<tr>
<td></td>
<td>A sluggish response to a light glabellar tap 5</td>
</tr>
<tr>
<td></td>
<td>No response 6</td>
</tr>
</tbody>
</table>
“No Patient Shall Be Harmed By Opioid-Induced Respiratory Depression”

[Proceedings of “Essential Monitoring Strategies to Detect Clinically Significant Drug-Induced Respiratory Depression in the Postoperative Period” Conference]
We recently have witnessed an explosive growth in the technology of equipment available to us for the care of our patients. This has come at a time when cost containment in medical care has become of paramount concern. Many would hide behind the premise of cost containment in justifying why equipment should not be obtained to properly monitor our patients. On the other hand, we must be the patient’s advocate and not compromise safety.

Minimal Requirements for Monitoring – 1986
Anesthesiology June 1986; 64(6):840-841

Jerome H. Modell, M.D.
Professor and Chairman
Department of Anesthesiology
University of Florida College of Medicine
Gainesville, Florida 32610-0254
Annual opportunity cost savings on one unit = $1.48 million from decreased ICU transfers
Beach Chair Position May Decrease Cerebral Perfusion
Catastrophic Outcomes Have Occurred

by David J. Cullen, MD, and Robert R. Kirby, MD

Magnetic resonance imaging (MRI) 1 week later showed changes in both cerebral hemispheres consistent with cortical resistance increase. Under nonanesthetized conditions, the effects were greater with tidal volume.
<table>
<thead>
<tr>
<th>Case</th>
<th>Baseline BP</th>
<th>Lowest BP</th>
<th>Duration Low BP</th>
<th>Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>47yo Shoulder Scope</td>
<td>125/83</td>
<td>SBP 80–90 (32% decr)</td>
<td>Most of case</td>
<td>Bilateral hemispheric cortical infarcts</td>
</tr>
<tr>
<td>57 yo Rotator Cuff</td>
<td>125/60</td>
<td>SBP 90–110 (20% decr)</td>
<td>?</td>
<td>Post. Infarct (midbrain &amp; thalamus)</td>
</tr>
<tr>
<td>53 yo Shoulder</td>
<td>130/70</td>
<td>80/50 to 90/50 (35% decr)</td>
<td>Most of case</td>
<td>Lt hemisph. watershed infarct</td>
</tr>
<tr>
<td>54 yo Shoulder Repl.</td>
<td>?</td>
<td>50/25, 70/40, 90/60 (cuff on leg)</td>
<td>SBP50–100 entire case</td>
<td>Medullary &amp; upper spinal cord infarcts</td>
</tr>
</tbody>
</table>

Does it matter where the BP is measured?

<table>
<thead>
<tr>
<th>Cuff Location</th>
<th>MAP @ Cuff (mm Hg)</th>
<th>MAP @ EAC (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper arm</td>
<td>60</td>
<td>36-52</td>
</tr>
<tr>
<td>Calf</td>
<td>70</td>
<td>12-36</td>
</tr>
</tbody>
</table>

1 mm Hg $\rightarrow$ 1.25 cm
0.77 mm Hg $\rightarrow$ 1 cm
Open Waterfall vs. Closed Siphon Models
Alperin et al, 2005

- 10 healthy awake subjects
- CBF decreased 12% from supine to sitting
“Classic” Cerebral Autoregulation Curve

Drummond Anesthesiology 1997
(autoregulation testing in 12 groups)

- LLA
- LLA – upper range
- Group mean LLA
- Autoregulatory range
Mean values are useful for papers, but…

99.7% of values = Mean +/- 3x S.D.
95.9% of values = Mean +/- 2x S.D.
68.2% of values = Mean +/- 1x S.D.
LLR = lower limit reserve

Ischemia

Infarction

autoregulatory range

mean blood pressure (mmHg)
Consider Correction for Cuff Pressure

Impact of the Management of Patients in the Beach Chair Position

Current Studies Warrant Caution with Hemodynamic Perfusion: What...
PRESS RELEASE

Anesthesia Patient Safety Foundation Awards a Grant to the Society for Pediatric Anesthesia

WAKE UP SAFE
The Pediatric Anesthesia Quality Improvement Initiative
Making Pediatric Anesthesia Even Safer
“Wake up Safe”—Wrong Sided Cases Reported to Registry

by Donald C. Tyler, MD, MBA

5 cases of wrong side procedures in 2008

• 2 regional blocks
  • no time out
• 3 surgical procedures
  • Side not noted on consent
  • Side marking removed with surgical prep
  • Appropriate imaging not displayed in OR
Preventing Pediatric Transfusion-Associated Incidents of Hyperkalemic Cardiac Arrest

A Wake Up Safe Quality Improvement Initiative

by Angela C. Lee, MD, and Eugenie S. Hettmiller, MD
Associated Factors

- Rapid transfusion, central line use
- Neonates, infants
- Low GFR, low CO / shock, higher baseline K+
- Irradiated PRBC

Preventative Measures

- Peripheral IVs, > 23G
- Washing PRBC, fresh PRBC (?)
- Reduction of additive solution, plasma volume
- Check ABG / K+ freq. w/ large tx
APSF Conferences
Instructional Videos
APSF Newsletter

APSF Patient Safety Initiatives
Standardization  
Technology  
Pharmacy / Prefilled / Premixed  
Culture
If my spine surgery went fine, why can’t I see?
Postoperative Visual Loss and Informed Consent

This issue of the APSF Newsletter opens with a personal and tragic account of postoperative visual loss (POVL) in an anesthesiologist and follows with an update on POVL, a comprehensive review of informed consent, and a spine surgeon’s perspective. We hope that these timely articles will increase awareness of POVL and encourage appropriate preoperative informed consent.

Informed Consent Requires Active Communication
Surgical Fire Injuries Continue to Occur
Prevention May Require More Cautious Use of Oxygen

The conditions placing patients at risk for surgical fires on the body surface are well-defined:1,7

- Procedures involving the head, neck, and upper chest (above T5)
- Use of an ignition source (electrosurgical or electrocautery devices, laser) in proximity to an oxidizer-enriched (oxygen, nitrous oxide) atmosphere.

Steps to decrease the likelihood of surgical fires on the body surface are well defined:1,7

- Determine if the patient is at risk for surgical fire;
- Surgical team discusses the strategy for preventing and managing a surgical fire in a high risk patient;
- Minimize the concentration of oxidizers (oxygen, nitrous oxide) near the surgical site;
- Safely manage ignition sources;
- Safely manage fuels (alcohol-based skin prep, drapes, oxygen masks, nasal cannulas, patient’s hair).

Despite the fact that we know which patients are at risk for fire and understand how to prevent a fire, SURGICAL FIRES CONTINUE TO OCCUR.
**Fire Prevention Algorithm**

**Is patient at risk for surgical fire?** *(Procedures involving the head, neck and upper chest/above T5 and use of an ignition source in proximity to an oxidizer.)*

- **YES**
  - Nurses and surgeons avoid pooling of alcohol based skin preparations and allow adequate drying time. Communication between surgeon and anesthesia professional prior to initial use of electrocautery.

- **NO**
  - Proceed but reassess for changes in fire risk frequently.

**Does patient require oxygen supplementation?**

- **YES**
  - Is >30% oxygen concentration required to maintain oxygen saturation?
    - **YES**
      - Secure airway with endotracheal tube or supraglottic device.
    - **NO**
      - Use delivery device such as blender or common gas outlet to maintain oxygen below 30%.

- **NO**
  - Room air sedation.

† Although securing the airway is preferred, for cases where using a device is undesirable or not feasible, oxygen accumulation may be minimized by air insufflation over the face and open draping to provide wide exposure of the surgical site to the atmosphere.

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*The following organizations have indicated their support for APSF’s efforts to increase awareness of the potential for surgical fires in at-risk patients: American Society of Anesthesiologists, American Association of Nurse Anesthetists, American Academy of Anesthesiologist Assistants, American College of Surgeons, American Society of Anesthesia Technologists and Technicians, American Society of PeriAnesthesia Nurses, Association of periOperative Registered Nurses, ICAI Institute, Food and Drug Administration Safe Use Initiative, National Patient Safety Foundation, The Joint Commission.*

**PROVIDED AS AN EDUCATIONAL RESOURCE BY THE Anesthesia Patient Safety Foundation**
APSF Announces Availability of Recently Released Educational DVDs

Visit the APSF website (www.apsf.org) to view the following DVDs and request a complimentary copy.

- Opioid-Induced Ventilatory Impairment (OIVI): Time for a Change in the Monitoring Strategy for Postoperative PCA Patients (7 minutes)

- Perioperative Visual Loss (POVL): Risk Factors and Evolving Management Strategies (10 minutes)

- APSF Presents Simulated Informed Consent Scenarios for Patients at Risk for Perioperative Visual Loss (POVL) Due to Ischemic Optic Neuropathy (18 minutes)
Emergency Manuals: The Time Has Come

Michael F. Mulroy, MD, for Emergency Manual Implementation Collaborative

It was a “standard” interscalene block for shoulder surgery, a single injection of a ropivacaine/tetracaine mixture under ultrasound guidance. But then the convolution started; the patient lost consciousness and stopped breathing. The blood pressure dropped, but sinus rhythm was maintained. The anesthesiologist reported, “I sort of froze: Four people were doing a lot of things at once, it was chaotic, but I remembered to get the checklist.” The checklist he remembered was the ASRA guideline for managing local anesthetic toxicity (LAST) that he had just simulated at a meeting, and which was now posted on the operating room wall. The checklist was read out loud; administration of a large dose of propofol (drawn up and being connected to the IV) was immediately stopped and Intralipid™ given instead in the correct dose. After following the steps on the list, the patient awakened with no permanent complications, and received surgery at a later date.

This is the story shared by Paul Preston, MD, of the Kaiser Hospital system in Northern California. He added that “using the checklist really helped the team get organized and more effectively do the correct steps. It greatly added to situational awareness. Nobody could remember the exact dose of Intralipid even though two of the providers had been through LAST simulation a month earlier—this let the team rapidly get it right.”

The reality is that none of us can any longer function as that “lone expert” recalling every procedure and drug dose from memory, especially in crisis situations. The American Heart Association has developed algorithms for managing cardiac arrest, the MHAUS association has a detailed checklist for managing malignant hyperthermia (www.mhaus.org), the Central Line Bundle is now used to prevent infections.
ASA/APSF
Ellison C. Pierce, Jr., MD,
Patient Safety
Memorial Lecture

Competence and Teamwork Are Not Enough: The Value of Cognitive Aids

David M. Gaba, MD

Annual Meeting of the American Society of Anesthesiologists
Saturday, October 11, 2014
New Orleans Morial Convention Center
Great Hall B (1 PM – 2 PM)

Board of Directors Workshop

Competence and Team Work are Not Enough: Implementing Emergency Manuals and Checklists

Saturday, October 11, 2014
New Orleans Morial Convention Center
Great Hall Ball (2 PM – 4 PM)