



Complete Summary

GUIDELINE TITLE

Practice advisory for the prevention and management of operating room fires.

BIBLIOGRAPHIC SOURCE(S)

American Society of Anesthesiologists Task Force on Operating Room Fires, Caplan RA, Barker SJ, Connis RT, Cowles C, de Richemond AL, Ehrenwerth J, Nickinovich DG, Pritchard D, Roberson D, Wolf GL. Practice advisory for the prevention and management of operating room fires. *Anesthesiology* 2008 May;108(5):786-801; quiz 971-2. [93 references] [PubMed](#)

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

SCOPE

METHODOLOGY - including Rating Scheme and Cost Analysis

RECOMMENDATIONS

EVIDENCE SUPPORTING THE RECOMMENDATIONS

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

QUALIFYING STATEMENTS

IMPLEMENTATION OF THE GUIDELINE

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT

CATEGORIES

IDENTIFYING INFORMATION AND AVAILABILITY

DISCLAIMER

SCOPE

DISEASE/CONDITION(S)

Injuries from operating room fires (fires that occur on the patient, in the airway, or in the breathing circuit)

GUIDELINE CATEGORY

Management

Prevention

Risk Assessment

CLINICAL SPECIALTY

Anesthesiology
Colon and Rectal Surgery
Neurological Surgery
Nursing
Orthopedic Surgery
Otolaryngology
Plastic Surgery
Surgery
Thoracic Surgery

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Hospitals
Nurses
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

- To identify situations conducive to fire
- To prevent the occurrence of operating room (OR) fires
- To reduce adverse outcomes associated with OR fires
- To identify the elements of a fire response protocol

Note: This Advisory does not address fires away from the patient (e.g., in a trash can), institutional preplanning for fire, or the responses of fire personnel.

TARGET POPULATION

Any patient having surgery in an operating room (OR)

INTERVENTIONS AND PRACTICES CONSIDERED

Prevention

1. Fire safety education
 - Fire prevention/management protocol
2. Preparation for fires
 - Operating room (OR) fire drills
 - Necessary equipment and supplies for extinguishing fires in the OR
 - Assessment of high-risk situation and development and assignment of fire management tasks
3. Intraoperative measures for minimizing risk in presence of an ignition source
 - High-risk procedures
 - Laser surgery
 - Airway surgery
 - Face, head and neck surgery

Management

1. Early warning signs of fire
2. Airway fire versus nonairway fire
3. Extinguishing the fire
4. Management of patient during fire and after fire is extinguished

MAJOR OUTCOMES CONSIDERED

- Incidence of operating room (OR) fires
- OR fire-related morbidity and injuries
- OR fire-related mortality

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

For the literature review, potentially relevant studies were identified via electronic and manual searches of the literature. The literature search covered a 56-yr period from 1952 through 2007. More than 400 citations were initially identified, yielding a total of 340 articles that addressed topics related to the evidence linkages and met our criteria for inclusion. After review of the articles, 240 studies did not provide direct evidence and were subsequently eliminated.

NUMBER OF SOURCE DOCUMENTS

A total of 100 articles contained direct linkage-related evidence.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Scientific Evidence

Study findings from published scientific literature were aggregated and are reported in summary form by evidence category.

Category A: Supportive: Randomized controlled trials report statistically significant ($P < 0.01$) differences between clinical interventions for a specified clinical outcome.

Level 1: The literature contains multiple randomized controlled trials, and the aggregated findings are supported by meta-analysis. §

Level 2: The literature contains multiple randomized controlled trials, but there is an insufficient number of studies to conduct a viable meta-analysis for the purpose of this Advisory.

Level 3: The literature contains a single randomized controlled trial.

§ All meta-analyses are conducted by the ASA methodology group. Meta-analyses from other sources are reviewed but not included.

Category B: Suggestive: Information from observational studies permits inference of beneficial or harmful relationships among clinical interventions and clinical outcomes.

Level 1: The literature contains observational comparisons (e.g., cohort, case-control research designs) of two or more clinical interventions or conditions and indicates statistically significant differences between clinical interventions for a specified clinical outcome.

Level 2: The literature contains noncomparative observational studies with associative (e.g., relative risk, correlation) or descriptive statistics.

Level 3: The literature contains case reports.

Category C: Equivocal: The literature cannot determine whether there are beneficial or harmful relationships among clinical interventions and clinical outcomes.

Level 1: Meta-analysis did not find significant differences among groups or conditions.

Level 2: There is an insufficient number of studies to conduct meta-analysis and (1) randomized controlled trials have not found significant differences among groups or conditions or (2) randomized controlled trials report inconsistent findings.

Level 3: Observational studies report inconsistent findings or do *not* permit inference of beneficial or harmful relationships.

Category D: Insufficient: the *lack of scientific evidence* in the literature is described by the following terms.

Silent: No identified studies address the specified relationships among interventions and outcomes.

Inadequate: The available literature cannot be used to assess relationships among clinical interventions and clinical outcomes. The literature either does not meet the criteria for content as defined in the "Focus" of the Advisory or it does not permit a clear interpretation of findings due to methodologic concerns (e.g., confounding in study design or implementation).

Opinion-based Evidence

Opinion surveys were developed by the Task Force to address each clinical intervention identified in the document. Identical surveys were distributed to two groups of respondents: expert consultants and American Society of Anesthesiologists (ASA) members.

Category A: Expert Opinion. Survey responses from Task Force-appointed expert consultants are reported in summary form in the text. A complete listing of consultant survey responses is reported in appendix 2 in the original guideline document.

Category B: Membership Opinion. Survey responses from a random sample of members of the ASA and, when appropriate, responses from members of other organizations with expertise in the selected topics of interest are reported in summary form in the text. A complete listing of ASA member survey responses is reported in appendix 2 in the original guideline document.

Survey responses are recorded using a five-point scale and summarized based on median values.

Strongly Agree: Median score of 5 (at least 50% of the responses are 5)

Agree: Median score of 4 (at least 50% of the responses are 4 or 4 and 5)

Equivocal: Median score of 3 (at least 50% of the responses are 3, or no other response category or combination of similar categories contains at least 50% of the responses)

Disagree: Median score of 2 (at least 50% of responses are 2 or 1 and 2)

Strongly Disagree: Median score of 1 (at least 50% of responses are 1)

Category C: Informal Opinion. Open-forum testimony, Web-based comments, letters, and editorials are all informally evaluated and discussed during the development of the Advisory. When warranted, the Task Force may add educational information or cautionary notes based on this information.

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

For this Advisory, a literature review was used in combination with opinions obtained from experts and other sources (e.g., professional society members, open forums, Web-based postings) to provide guidance to practitioners regarding operating room (OR) fire prevention and management. Both the literature review and opinion data were based on *evidence linkages*, or statements regarding potential relationships between fire prevention and management interventions and OR fire outcomes.

No evidence linkage contained enough studies with well-defined experimental designs and statistical information to conduct a quantitative analysis (i.e., meta-analysis).

Interobserver agreement among Task Force members and two methodologists was established by inter-rater reliability testing. Agreement levels using a k statistic for two-rater agreement pairs were as follows:

(1) type of study design, $k = 0.63-0.82$; (2) type of analysis, $k = 0.40-0.87$; (3) evidence linkage assignment, $k = 0.84-1.00$; and (4) literature inclusion for database, $k = 0.69-1.00$. Three-rater chance-corrected agreement values were (1) study design, $Sav = 0.69$, $Var(Sav) = 0.013$; (2) type of analysis, $Sav = 0.57$, $Var(Sav) = 0.031$; (3) linkage assignment, $Sav = 0.89$, $Var(Sav) = 0.004$; and (4) literature database inclusion, $Sav = 0.79$, $Var(Sav) = 0.025$. These values represent moderate to high levels of agreement.

Consensus-based Evidence

Consensus was obtained from multiple sources, including (1) survey opinion from consultants who were selected based on their knowledge or expertise in OR fire prevention and management, (2) survey opinions solicited from active members of the American Society of Anesthesiologists (ASA), (3) testimony from attendees of a publicly held open forum at a national anesthesia meeting, (4) Internet commentary, and (5) Task Force opinion and interpretation. The survey rate of return was 52% ($n = 38$ of 73) for the consultants, and 64 surveys were received from active ASA members. Results of the surveys are reported in tables 2 and 3 in the original guideline document and in the text of the Advisory.

The consultants were asked to indicate which, if any, of the evidence linkages would change their clinical practices if the Advisory was instituted. The rate of return was 18% ($n = 13$ of 73). The percent of responding consultants expecting a change in their practice associated with each linkage topic was as follows: (1) education, 77%; (2) OR fire drills, 69%; (3) team discussion of fire strategy, 69%; (4) minimizing or avoiding an oxidizer-enriched atmosphere near the surgical site, 38%; (5) managing ignition sources, 38%; (6) managing fuels, 31%; (7) identification of a high-risk procedure, 85%; (8) management of a high-risk procedure, 31%; and (9) OR fire management, 77%. Eighty-five percent of the respondents indicated that the Advisory would have *no effect* on the amount of time spent on a typical case, and 15% indicated that there would be an increase of 1 to 5 min in the amount of time spent on a typical case with the implementation of this Advisory.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The American Society of Anesthesiologists (ASA) appointed a Task Force of nine members. These individuals included four anesthesiologists in private and

academic practice from various geographic areas of the United States, an otolaryngologist, a perioperative registered nurse, a professional engineer/fire investigator, and two consulting methodologists from the ASA Committee on Standards and Practice Parameters. Two Task Force members are former firefighters.

The Task Force developed the Advisory by means of a seven-step process. First, they reached consensus on the criteria for evidence. Second, a systematic review and evaluation was performed on original, published, peer-reviewed and other research studies related to operating room (OR) fires. Third, a panel of expert consultants was asked to (1) participate in opinion surveys on the effectiveness of various strategies for fire prevention, detection, and management and (2) review and comment on a draft of the Advisory developed by the Task Force. Fourth, opinions about the Advisory were solicited from a random sample of active members of the ASA. Fifth, the Task Force held an open forum at a major national meeting to solicit input on its draft recommendations. Sixth, the consultants were surveyed to assess their opinions on the feasibility of implementing this Advisory. Seventh, all available information was used to build consensus within the Task Force to formulate the advisory statements (See Appendix 1 in the original guideline document).

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The panel of expert consultants was asked to review and comment on draft reports. The Task Force held an open forum at a major national anesthesia meeting to solicit input from attendees on a draft of the Guidelines.

This Practice Advisory has been endorsed by the American Academy of Otolaryngology–Head and Neck Surgery.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

I. Education

- All anesthesiologists should have fire safety education, specifically for operating room (OR) fires, with emphasis on the risk created by an oxidizer-enriched atmosphere.

II. **OR Fire Drills**

- Anesthesiologists should periodically participate in OR fire drills, with the entire OR team. This formal rehearsal should take place during dedicated educational time, not during patient care.

III. **Preparation**

- For every case, the anesthesiologist should participate with the entire OR team (e.g., during the surgical pause) in assessing and determining whether a high-risk situation exists.
- If a high-risk situation exists, all team members—including the anesthesiologist—should take a joint and active role in agreeing on how a fire will be prevented and managed.
- Each team member should be assigned a specific fire management task to perform in the event of a fire (e.g., removing the tracheal tube, turning off the airway gases).
- Each team member should understand that his or her preassigned task should be performed immediately if a fire occurs, without waiting for another team member to take action.
- When a team member has completed a preassigned task, he or she should help other team members perform tasks that are not yet complete.
- In every OR and procedure area where a fire triad can exist (i.e., an oxidizer-enriched atmosphere, an ignition source, and fuel), an easily visible protocol for the prevention and management of fires should be displayed.
- Equipment for managing a fire should be readily available in every procedural location where a fire triad may exist.

IV. **Prevention**

- The anesthesiologist should collaborate with all members of the procedure team *throughout the procedure* to minimize the presence of an oxidizer-enriched atmosphere in proximity to an ignition source.
- For all procedures:
 - Surgical drapes should be configured to minimize the accumulation of oxidizers (oxygen and nitrous oxide) under the drapes and from flowing into the surgical site.
 - Flammable skin prepping solutions should be dry before draping.
 - Gauze and sponges should be moistened before use in proximity to an ignition source.
- For high-risk procedures:
 - The anesthesiologist should notify the surgeon whenever there is a potential for an ignition source to be in proximity to an oxidizer-enriched atmosphere or when there is an increase in oxidizer concentration at the surgical site.
 - Any reduction in supplied oxygen to the patient should be assessed by monitoring (1) pulse oximetry and, if feasible, (2) inspired, exhaled, and/or delivered oxygen concentration.

- For laser procedures:
 - A laser-resistant tracheal tube should be used.
 - The laser-resistant tracheal tube used should be chosen to be resistant to the laser used for the procedure (e.g., carbon dioxide [CO₂], neodymium-doped yttrium aluminium garnet [Nd:YAG], Ar, erbium-doped yttrium aluminium garnet [Er:YAG], potassium titanyl phosphate [KTP]).
 - The tracheal cuff of the laser tube should be filled with saline and colored with an indicator dye such as methylene blue.
 - Before activating a laser:
 - The surgeon should give the anesthesiologist adequate notice that the laser is about to be activated.
 - The anesthesiologist should:
 - *Reduce* the delivered oxygen concentration to the minimum required to avoid hypoxia.
 - *Stop* the use of nitrous oxide.
 - *Wait* a few minutes after reducing the oxidizer-enriched atmosphere before approving activation of the laser.
- For cases involving an ignition source and surgery inside the airway:
 - Cuffed tracheal tubes should be used when clinically appropriate.
 - The anesthesiologist should advise the surgeon against entering the trachea with an ignition source (e.g., electro-surgery unit).
 - *Before* activating an ignition source inside the airway:
 - The surgeon should give the anesthesiologist adequate notice that the ignition source is about to be activated.
 - The anesthesiologist should:
 - *Reduce* the delivered oxygen concentration to the minimum required to avoid hypoxia.
 - *Stop* the use of nitrous oxide.
 - *Wait* a few minutes after reducing the oxidizer-enriched atmosphere before approving the activation of the ignition source.
 - In some cases (e.g., surgery in the oropharynx), scavenging with suction may be used to reduce oxidizer enrichment in the operative field.
- For cases involving moderate or deep sedation, an ignition source, and surgery around the face, head, or neck:
 - The anesthesiologist and surgeon should develop a plan that accounts for the level of sedation and the patient's need for supplemental oxygen.
 - If moderate or deep sedation is required or used, or if the patient exhibits oxygen dependence, the anesthesiologist and surgeon should consider a sealed gas delivery device (e.g., cuffed tracheal tube or laryngeal mask).
 - If moderate or deep sedation is not required, and the patient does not exhibit oxygen dependence, an open gas delivery device (e.g., facemask or nasal cannula) may be considered.

- Before activating an ignition source around the face, head, or neck:
 - The surgeon should give the anesthesiologist adequate notice that the ignition source is about to be activated.
 - The anesthesiologist should:
 - *Stop* the delivery of supplemental oxygen or reduce the delivered oxygen concentration to the minimum required to avoid hypoxia.
 - *Wait* a few minutes after reducing the oxidizer-enriched atmosphere before approving the activation of the ignition source.

V. **Management of OR Fires**

- When an early warning sign is noted, halt the procedure and call for an evaluation of fire.
- When a fire is definitely present, immediately announce the fire, halt the procedure, and initiate fire management tasks.
- Team members should perform their preassigned fire management tasks as quickly as possible.
 - Before the procedure, the team may identify a predetermined order for performing the tasks.
 - If a team member cannot rapidly perform his or her task in the predetermined order, other team members should perform their tasks without waiting.
 - When a team member has completed a preassigned task, he or she should help other members perform tasks that are not yet complete.
- For a fire in the airway or breathing circuit, as fast as possible:
 - Remove the tracheal tube.
 - Stop the flow of all airway gases.
 - Remove all flammable and burning materials from the airway.
 - Pour saline or water into the patient's airway.
- For a fire elsewhere on or in the patient, as fast as possible:
 - Stop the flow of all airway gases.
 - Remove all drapes, flammable, and burning materials from the patient.
 - Extinguish all burning materials in, on, and around the patient (e.g., with saline, water, or smothering).
- If the airway or breathing circuit fire is extinguished:
 - Reestablish ventilation by mask, avoiding supplemental oxygen and nitrous oxide, if possible.
 - Extinguish and examine the tracheal tube to assess whether fragments were left in the airway.
 - Consider bronchoscopy (preferably rigid) to look for tracheal tube fragments, assess injury, and remove residual debris.
 - Assess the patient's status and devise a plan for ongoing care.
- If the fire elsewhere on or in the patient is extinguished:
 - Assess the patient's status and devise a plan for ongoing care of the patient.
 - Assess for smoke inhalation injury if the patient was not intubated.

- If the fire is *not* extinguished after the first attempt (e.g., after performing the preassigned tasks):
 - Use a CO₂ fire extinguisher in, on, or around the patient.
 - If the fire persists after use of the CO₂ fire extinguisher:
 - Activate the fire alarm.
 - Evacuate the patient if feasible, following institutional protocols.
 - Close the door to the room to contain the fire and do not reopen it or attempt to reenter the room.
 - Turn off the medical gas supply to the room.
- Follow local regulatory reporting requirements (e.g., report fires to your local fire department and state department of health).
- Treat every fire as an adverse event, following your institutional protocol.

CLINICAL ALGORITHM(S)

A clinical algorithm for operating room fires is provided in the original guideline document.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

Evidence was obtained from two principal sources: scientific evidence and opinion-based evidence.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Prevent the occurrence of operating room (OR) fires
- Reduce adverse outcomes associated with OR fires

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- Advisories developed by the American Society of Anesthesiologists (ASA) are not intended as standards, guidelines, or absolute requirements. They may be adopted, modified, or rejected according to clinical needs and constraints.
- The use of practice advisories cannot guarantee any specific outcome. Practice advisories summarize the state of the literature and report opinions obtained from expert consultants and ASA members. Practice advisories are not supported by scientific literature to the same degree as standards or guidelines because of the lack of sufficient numbers of adequately controlled

studies. Practice advisories are subject to periodic revision as warranted by the evolution of medical knowledge, technology, and practice.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided

IMPLEMENTATION TOOLS

Clinical Algorithm
Staff Training/Competency Material

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Staying Healthy

IOM DOMAIN

Effectiveness
Safety
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

American Society of Anesthesiologists Task Force on Operating Room Fires, Caplan RA, Barker SJ, Connis RT, Cowles C, de Richemond AL, Ehrenwerth J, Nickinovich DG, Pritchard D, Roberson D, Wolf GL. Practice advisory for the prevention and management of operating room fires. *Anesthesiology* 2008 May;108(5):786-801; quiz 971-2. [93 references] [PubMed](#)

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2008 May

GUIDELINE DEVELOPER(S)

American Society of Anesthesiologists - Medical Specialty Society

SOURCE(S) OF FUNDING

American Society of Anesthesiologists

GUIDELINE COMMITTEE

Task Force on Operating Room Fires

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Task Force Members: Robert A. Caplan, M.D. (Chair), Seattle, Washington; Steven J. Barker, Ph.D., M.D., Tucson, Arizona; Richard T. Connis, Ph.D., Woodinville, Washington; Charles Cowles, M.D., Deer Park, Texas; Albert L. de Richmond, M.S., P.E., Plymouth Meeting, Pennsylvania; Jan Ehrenwerth, M.D., Madison, Connecticut; David G. Nickinovich, Ph.D., Bellevue, Washington; Donna Pritchard, R.N., Brooklyn, New York; David Roberson, M.D., Boston, Massachusetts; Gerald L. Wolf, M.D. (Honorary), Brooklyn, New York

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

ENDORSER(S)

American Academy of Otolaryngology - Head and Neck Surgery - Medical Specialty Society

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available from the [Anesthesiology Journal Web site](#).

Print copies: Available from the American Society for Anesthesiologists, 520 North Northwest Highway, Park Ridge, IL 60068-2573.

AVAILABILITY OF COMPANION DOCUMENTS

A continuing medical education (CME) activity is available from the [Anesthesiology Journal Web site](#).

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI Institute on July 9, 2008. The information was verified by the guideline developer on July 23, 2008.

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