Anesthesiology 2005; 103:33–9

Management of the Difficult Airway

A Closed Claims Analysis

Gene N. Peterson, M.D., Ph.D., Karen B. Domino, M.D., M.P.H.,† Robert A. Caplan, M.D.,‡ Karen L. Posner, Ph.D.,§ Lorri A. Lee, M.D.,* Frederick W. Cheney, M.D.‖*

Background: **The purpose of this study was to identify the patterns of liability associated with malpractice claims arising from management of the difficult airway.**

Methods: **Using the American Society of Anesthesiologists Closed Claims database, the authors examined 179 claims for difficult airway management between 1985 and 1999 where a supplemental data collection tool was used and focused on airway management, outcomes, and the role of the 1993 Difficult Airway Guidelines in litigation. Chi-square tests and multiple logistic regression analysis compared risk factors for death or brain damage (death/BD) from two time periods: 1985–1992 and 1993–1999.**

Results: **Difficult airway claims arose throughout the perioperative period: 67% upon induction, 15% during surgery, 12% at extubation, and 5% during recovery. Death/BD with induction of anesthesia decreased in 1993–1999 (35%) compared with 1985–1992 (62%; $P < 0.05$; odds ratio, 0.26; 95% confidence interval, 0.11–0.63; $P = 0.003$). In contrast, death/BD associated with other phases of anesthesia did not significantly change over the time periods. The odds of death/BD were increased by the development of an airway emergency (odds ratio, 14.98; 95% confidence interval, 6.37–35.27; $P < 0.001$). During airway emergencies, persistent intubation attempts were associated with death/BD ($P < 0.05$). Since 1993, the Airway Guidelines were used to defend care (8%) and criticize care (3%).**

Conclusions: **Death/BD in claims from difficult airway management associated with induction of anesthesia but not other phases of anesthesia decreased in 1993–1999 compared with 1985–1992. Development of additional management strategies for difficult airways encountered during maintenance, emergence, or recovery from anesthesia may improve patient safety.**

RESPIRATORY system adverse events represent the most common mechanism leading to anesthesia malpractice claims, accounting for a large proportion of claims for death and brain damage in the American Society of Anesthesiologists (ASA) Closed Claims database.[1] After the introduction of the ASA Guidelines for the Management of the Difficult Airway in 1993,[2] we collected supplemental information about the process of airway management in closed claims involving difficult airways. In this study, we reviewed the supplemental information to identify the patterns of liability associated with claims arising from management of the difficult airway.

This article is featured in "This Month in Anesthesiology." Please see this issue of ANESTHESIOLOGY, page 5A.

* Assistant Professor, ‖ Professor and Chair, Department of Anesthesiology, † Professor, Department of Anesthesiology and Neurological Surgery (Adjunct), § Research Associate Professor, Department of Anesthesiology and Anthropology (Adjunct), University of Washington. ‡ Clinical Professor, Department of Anesthesiology, University of Washington. Staff Anesthesiologist, Virginia Mason Medical Center, Seattle, Washington.

Received from the Department of Anesthesiology, University of Washington, Seattle, Washington. Submitted for publication October 14, 2004. Accepted for publication April 20, 2005. Supported by the American Society of Anesthesiologists, Park Ridge, Illinois. All opinions expressed are those of the authors and do not reflect the policy of the American Society of Anesthesiologists.

Address reprint requests to Dr. Domino: Department of Anesthesiology, Box 356540, University of Washington School of Medicine, 1959 Northeast Pacific Street, Seattle, Washington 98195-6540. Address electronic mail to: kdomino@u.washington.edu. Individual article reprints may be purchased through the Journal Web site, www.anesthesiology.org.

Materials and Methods

The ASA Closed Claims Project is a structured evaluation of adverse anesthetic outcomes obtained from the closed claims files of 35 U.S. professional liability insurance companies representing anesthesiologists. Claims for dental damage are not included in the database. The data collection process has been previously described in detail.[3,4] Briefly, each closed claims file was reviewed by a practicing anesthesiologist and typically consisted of relevant hospital and medical records; narrative statements from involved healthcare personnel; expert and peer reviews; summaries of depositions from plaintiffs, defendants, and expert witnesses; outcome reports; and cost of settlement or jury award. The reviewer completed a standardized form that recorded information about patient characteristics, surgical procedures, sequence and location of events, critical incidents, clinical manifestations of injury, standard of care, and outcome. The reliability of reviewer judgments regarding appropriateness of care is acceptable.[5]

For the current study, detailed supplemental data regarding airway management was completed by the onsite reviewer for difficult airway claims collected between January 1993 and December 2003. Reviewers completed 186 forms representing events from 1978 to 1999. Claims from events arising before 1985 (n = 7) were excluded, resulting in a total of 179 claims.

The supplemental data collection form focused on preoperative airway evaluation and planning, specific approaches to airway management, the nature and severity of outcomes, and the role of the ASA Difficult Airway Guidelines[2] in litigation. Specific questions regarding preoperative care included whether an airway history or physical examination was conducted. Questions on airway management included listing of airway conditions that were anticipated, the first strategy of airway management attempted, and secondary strategies used. In the event of an airway emergency (defined as a "cannot ventilate and cannot intubate" situation), the reviewers recorded whether help was called or was immediately available. The reviewer noted whether there were persistent attempts at intubation using con-

ventional techniques before attempting emergency nonsurgical ventilation or an emergency surgical airway, what emergency nonsurgical ventilation techniques were used, or whether there was an attempt to establish a surgical airway. If an airway was ultimately secured, reviewers recorded whether this was confirmed by end-tidal capnography and whether there was a preformulated strategy for extubation. Additional questions addressed postoperative documentation and the role of the Difficult Airway Guidelines in the litigation of the claim. To familiarize reviewers with the supplemental data collection form, each reviewer was provided a typical difficult airway case report from the published literature and a corresponding completed supplemental data collection tool.

Perioperative care was defined as anesthesia care occurring in the continuum of care from the time the anesthesiologist assumed care of the patient through the recovery phase. *Preinduction* refers to claims where the damaging event occurred after the anesthesiologist assumed care of the patient but before the time the provider anticipated managing the airway before induction of anesthesia. Examples included sedation and airway difficulties in the holding area of the operating room or airway difficulties during placement of invasive monitoring. *Induction* refers to claims that had a damaging event that occurred on initiation of anesthesia in the operating room. In the case of general anesthesia, it occurred during an awake intubation or after drugs had been administered either to render the patient unconscious or to stop respiration. In the event of regional anesthesia, the airway difficulty followed a seizure from local anesthetics. *Intraoperative* refers to claims where the damaging event occurred when the surgical procedure was in progress. Examples for patients undergoing general anesthesia included loss of the endotracheal tube during the case, or during an anesthetic using a mask or laryngeal mask airway (LMA) where airway management became difficult. For a case during regional anesthesia, examples included a failed regional block necessitating conversion to general anesthesia or a regional anesthetic where there was a physiologic emergency such as a pulmonary embolus or unstable cardiac rhythm necessitating resuscitation and airway management. *Extubation* in the operating room refers to claims where the damaging event was at the conclusion of the surgical case. There may have been a difficult airway on induction or intraoperatively, but the injury or damaging event was temporally associated with extubation of the patient in the operating room. In this case, the anesthesiologist typically had the operating room resources of an anesthesia machine and standard airway management equipment. *Recovery* refers to claims where the injury or liability related to difficult airway occurred in the postanesthesia recovery phase of anesthesia care. This category included patients who experienced airway difficulties after extubation in the recovery room, patients who were sedated or had residual muscle paralysis necessitating airway management, and patients who had a physiologic emergency during recovery (cardiac arrhythmia, pulmonary embolus, pneumothorax) necessitating resuscitation.

The term *outside locations* was used to identify claims in which the airway problem occurred outside of the perioperative environment, in areas such as the emergency room, the intensive care unit, or the hospital ward. Claims occurring in outside locations were not immediately associated with anesthesia preparation for surgery, the surgical procedure itself, or recovery care. The assignment of location of injury was determined by three of the authors (G.N.P., K.L.P., and K.B.D.).

Statistical Analysis

For analysis, claims were divided into two time periods before and after publication of the Difficult Airway Guidelines (1985–1992 and 1993–1999). Patient and case characteristics, outcomes, and liability were compared between the two time periods and between perioperative and outside location claims.

Differences between proportions were tested by chi-square tests, Fisher exact tests, and the Z test. Univariate and multiple logistic regression analyses (forward selection) were used to find associations of time period, anticipation of a difficult airway, difficult mask ventilation, phase of anesthetic (induction *vs.* others), and development of an airway emergency with death or brain damage (death/BD). Payment amounts were adjusted to 1999 dollars using the consumer price index.# Payment amounts were compared for differences in their distribution using the Kolmogorov-Smirnov test with Monte Carlo significance calculated from 10,000 sampled tables. Two-tailed tests were used to determine statistical significance at $P < 0.05$.

Results

Overview of Claims

Patient/Case Characteristics. Of 179 claims for difficult airway management, 48% (n = 86) were from events in 1985–1992, and 52% (n = 93) were from events in 1993–1999. Eighty-seven percent (n = 156) of claims for difficult airway management involved perioperative care, and 13% (n = 23) involved outside locations. Perioperative claims had a larger proportion of females ($P < 0.05$), patients with ASA physical status of I or II ($P < 0.01$), and patients undergoing general ($P < 0.05$), orthopedic ($P < 0.01$), or gynecologic/urologic ($P < 0.05$) surgery compared with claims from outside

U.S. Department of Labor, Bureau of Labor Statistics Inflation Calculator. Available at: http://data.bls.gov/cgi-bin/cpicalc.pl. Accessed April 20, 2005.

Table 1. Patient and Case Characteristics

	Perioperative (n = 156), n (%)	Outside Locations (n = 23), n (%)
Sex		
Female	91 (58%)*	7 (30%)*
ASA physical status		
I or II	80 (51%)†	2 (9%)†
III–V	72 (46%)†	20 (87%)†
Emergency	39 (25%)	10 (43%)
Age, yr, mean ± SD	49 ± 17	46 ± 17
Obese	65 (42%)‡	9 (39%)‡
Procedure scheduled as		
Inpatient	112 (72%)†	22 (96%)†
Outpatient	39 (25%)†	1 (4%)†
Surgical procedure group		
General surgery	44 (28%)*	2 (9%)*
Orthopedics	28 (18%)†	0 (0%)†
Head, neck, ENT	33 (21%)	3 (13%)
Vascular/cardiothoracic	15 (10%)	3 (13%)
Neurologic/spine	10 (6%)	3 (13%)
Cesarean delivery	9 (6%)	0 (0%)
Gynecology/urology	13 (8%)*	0 (0%)*
Other	4 (3%)†	12 (52%)†
Date of event		
1985–1992	73 (47%)	13 (57%)
1993–1999	83 (53%)	10 (43%)

* $P < 0.05$ perioperative *vs.* outside locations. † $P < 0.01$ perioperative *vs.* outside locations. ‡ Obesity defined by on-site reviewer or body mass index > 30.

ASA = American Society of Anesthesiologists; ENT = ear, nose, and throat.

Table 2. Outcomes and Liability in Difficult Airway Claims (n = 179)

	Perioperative (n = 156), n (%)	Outside Location (n = 23), n (%)
Outcome		
Death	71 (46%)*	20 (87%)*
Brain damage	19 (12%)	3 (13%)
Airway injury†	50 (32%)*	0 (0%)*
Pneumothorax	7 (4%)	0 (0%)
Aspiration pneumonitis	3 (2%)	0 (0%)
Nerve injury	3 (2%)	0 (0%)
Emotional distress/ fright	3 (2%)	0 (0%)
Awake during surgery	1 (1%)	0 (0%)
Liability		
Less than appropriate anesthetic care	74 (47%)	10 (43%)
Payment made	99 (63%)	13 (57%)
Payments in 1999 dollars, median (range)	$271,250 ($2,240–8,540,000)	$305,000 ($49,050–2,010,000)

* $P < 0.01$ perioperative *vs.* outside location. † Airway injury included esophageal (n = 15), laryngeal (n = 11), nasal (n = 5), pharyngeal (n = 2), tracheal (n = 17).

locations (table 1). Perioperative patients had a decrease in proportion of emergency surgery in 1993–1999 (17%) *versus* 1985–1992 (38%) ($P < 0.01$). Otherwise, patient and case characteristics were not different in the two time periods.

Severity of Injury. Death or brain damage occurred in more than half of the perioperative claims and all of the outside location claims ($P < 0.01$, perioperative *vs.* outside location; table 2). Airway injury occurred in a third of perioperative claims ($P < 0.01$ *vs.* outside location; table 2). Emergency procedures were associated with more severe outcomes than elective procedures (86% *vs.* 55% death/BD; $P < 0.01$). The proportion of claims for death in the perioperative period decreased in 1993–1999 compared with 1985–1992 (36% *vs.* 56%; $P < 0.05$).

Liability. There was no difference in liability in the two time periods or between perioperative and outside location claims (table 2). Care was judged to be less than appropriate in nearly half of the difficult airway claims (table 2). Payment was made in more than half of the difficult airway claims, and the median payments were similar in the perioperative period and in outside locations (table 2). Death/BD claims had higher payments (median, $424,000) compared with less severe injury claims (median, $72,333; $P < 0.01$).

For claims between 1993 and 1999 (n = 93), the Guidelines were discussed in only 17 (18%) of the claims. They were useful in the defense of 7 claims (8%) and implicated substandard care in 3 claims (3%).

Clinical Description of Claims

Outside Locations. A quarter of claims for outside locations involved endotracheal tube change, and nearly half involved nonsurgical care. Reintubation on the ward or intensive care unit after surgical procedures involved neck swelling with respiratory distress after cervical fusion (n = 3), total thyroidectomy (n = 1), intraoral/pharyngeal procedures (n = 2), and fluid extravasation from a central catheter (n = 1).

Perioperative Claims. The difficult airway was encountered throughout the perioperative period: two thirds upon induction and the remaining third during surgery (15%), extubation (12%), or recovery (5%; table 3). The proportion of claims associated with induction of anesthesia resulting in death/BD was decreased in 1993–1999 (35%) compared with 1985–1992 (62%; table 3). In contrast, injuries arising from intraoperative, extubation, or recovery periods in the two time periods remained severe (table 3).

Eight percent (n = 12) did not have a history or airway physical examination documented. For those perioperative claims with a documented history or physical, a difficult airway condition (difficult intubation [n = 49], difficult mask ventilation [n = 8], and difficulty with patient cooperation [n = 5]) was anticipated in more than half of the claims.

Table 3. Timing of Perioperative Claims (n = 156)

Timing	1985–1992 (n = 73)		1993–1999 (n = 83)	
	Claims, n (%)	Death/BD, n (row %)*	Claims, n (%)	Death/BD, n (row %)*
Preinduction (n = 3)	2 (3)	2 (100)	1 (1)	1 (100)
Induction (n = 104)	52 (71)	32 (62)†	52 (63)	18 (35)†
Intraoperative (n = 23)	11 (15)	6 (55)	12 (14)	10 (83)
Extubation in operating room (n = 18)	6 (8)	6 (100)	12 (14)	10 (83)
Recovery (n = 8)	2 (3)	1 (50)	6 (7)	4 (67)

* Percent of row resulting in death or brain damage (death/BD). † Bonferroni $P = 0.04$, 1993–1999 *vs.* 1985–1992.

Preinduction claims resulted from unmonitored administration of sedation (n = 1), diversion of attention during invasive monitoring (n = 1), or loss of the airway while preparing for induction (n = 1).

Of the 104 claims associated with *induction of anesthesia*, 37% were obese, and one patient had acromegaly with sleep apnea. In the 38 claims with an anticipated difficult airway, the first strategy was more often intubation after induction of general anesthesia with ventilation ablated (61%) than awake intubation (32%). For claims in which a difficult airway condition was not anticipated, intubation after induction of general anesthesia with ventilation ablated was mostly used (94%). There was no difference in outcome in claims with use of succinylcholine (n = 63) and nondepolarizing muscle relaxants (n = 29). One claim associated with induction of regional anesthesia occurred during resuscitation from an intravascular injection.

Awake intubation was attempted but unsuccessful in 12 claims, resulting in death/BD in 75%. In 5 of these claims, upper airway obstruction developed after minimal sedation or airway instrumentation (Ludwig angina [n = 2], retropharyngeal abscess [n = 2], and bleeding carotid endarterectomy [n = 1]). In 1 claim, severe bronchospasm occurred after awake intubation. In 5 claims, airway difficulties arose when general anesthesia was induced after unsuccessful awake intubation due to lack of patient cooperation (n = 2) or technical factors (n = 3).

The 23 claims associated with the *intraoperative period* involved endotracheal tube change, obstruction, or inadvertent extubation (n = 7); intraoperative loss of airway during mask, LMA, or monitored anesthesia care (n = 10); failed regional anesthesia (n = 3); and physiologic emergencies such as bronchospasm, embolism, or allergic reaction (n = 2).

For the 18 claims associated with *extubation in the operating room*, 28% (n = 5) had a difficult intubation on induction of anesthesia, 11% (n = 2) had an awake intubation on induction, 67% (n = 12) were obese, and 28% (n = 5) had a history of obstructive sleep apnea.

Table 4. Perioperative Emergency (n = 75): Management and Outcome

	Total, n (%)*	Death or Brain Damage, n (%)†
Call for help/help available (n = 65)		
Yes	61 (94%)	51 (84%)
No	4 (6%)	4 (100%)
Persistent intubation attempts (n = 71)		
Yes	33 (46%)	31 (94%)‡
No	38 (54%)	28 (74%)‡
Emergency nonsurgical airway§ attempted (n = 71)		
Yes	31 (44%)	28 (90%)
No	40 (56%)	31 (78%)
Surgical airway attempted (n = 75)		
Yes	579 (76%)	48 (84%)
No	18 (24%)	15 (83%)
Definitive airway secured (n = 75)		
Yes	69 (92%)	58 (84%)
No	6 (8%)	5 (83%)

* Claims with missing data excluded. † Percent of claims with this management that resulted in death or brain damage. ‡ $P < 0.05$ between percent with death/brain damage in yes *vs.* no group. § Includes transtracheal jet ventilation, laryngeal mask airway, and esophageal tracheal Combitube®.

For the 8 claims associated with *airway management during recovery*, 2 had a difficult airway on induction of anesthesia, 1 had an awake intubation, and 3 were obese. Therefore, the majority (19 of 26) of the claims from extubation or recovery were associated with a difficult intubation on induction, obesity, and/or sleep apnea.

Perioperative Airway Emergency. In claims where an emergency airway situation developed (n = 75), the outcome was worse with persistent attempts at intubation before attempting emergency nonsurgical ventilation or emergency surgical airway access ($P < 0.05$; table 4). Outcomes were poor even if a surgical airway was attempted and ultimately secured (table 4).

Rescue Techniques. The LMA was used as a successful bridge to restore the airway in 5 claims with a nonemergency situation. However, in the emergency setting, a variety of rescue techniques were used, including LMA (n = 5), Combitube® (n = 2; Tyco-Kendall, Mansfield, MA), retrograde techniques (n = 1), jet ventilation (n = 9), or needle cricothyrotomy without jet ventilation (n = 15), and all were associated with poor outcomes. Jet ventilation caused subcutaneous emphysema, pneumothorax, or pneumomediastinum in 89% of the claims in which this technique was used. The only change in rescue techniques with time was the use of the LMA in 1993–1999, but not in 1985–1992.

Table 5. Univariate Analysis of Factors Associated with Death or Brain Damage in Perioperative Claims

Variable	n	OR (95% CI)	P Value
Time period			
1985–1992	73	Reference	
1993–1999	83	0.60 (0.31–1.13)	0.11
Difficult airway anticipated			
No	97	Reference	
Yes	59	1.11 (0.58–2.15)	0.75
Difficult mask ventilation			
No	91	Reference	
Yes	65	4.25 (2.09–8.65)	< 0.001
Induction phase			
No	52	Reference	
Yes	104	0.278 (0.13–0.59)	0.001
Airway emergency			
No	71	Reference	
Yes	75	15.46 (6.83–35.0)	< 0.001

Multivariate logistic regression found airway emergency increased the odds of death or brain damage (odds ratio [OR], 14.98; 95% confidence interval [CI], 6.37–35.27; $P < 0.001$). The odds of death or brain damage was decreased in claims associated with induction in 1993–1999 compared with 1985–1992 (OR, 0.26; 95% CI, 0.11–0.63; $P = 0.003$).

Factors Associated with Death or Brain Damage in Perioperative Claims

Univariate logistic regression analysis demonstrated that difficult mask ventilation and the development of an airway emergency increased the odds of death/BD (table 5). The odds of death/BD were reduced when the difficult airway was encountered during induction compared with other anesthesia phases (table 4). Multiple logistic regression analysis demonstrated that development of an airway emergency markedly increased the odds of death/BD (odds ratio, 14.98; 95% confidence interval, 6.37–35.27; $P < 0.001$). The odds of death/BD were decreased in claims associated with induction in 1993–1999 compared with 1985–1992 (odds ratio, 0.26; 95% confidence interval, 0.11–0.63; $P = 0.003$).

Discussion

Death or brain damage in claims from difficult airway management associated with induction of anesthesia decreased in 1993–1999 compared with 1985–1992. In contrast, death/BD associated with maintenance, extubation, or recovery was not significantly different in the two time periods.

Study Limitations

When interpreting our results, it should be emphasized that closed claims analysis has a number of well-described limitations, including retrospective, nonrandomized data collection and the lack of denominator data.[3] Closed claims data only provide an indirect assessment of complications and liability risks of management of the difficult airway. If a difficult airway is successfully managed, it is not likely to result in legal action. Therefore, analysis of closed malpractice claims cannot estimate the relative safety/efficacy of rescue techniques such as the LMA or surgical airway in the management of the difficult airway. Malpractice claims are biased by the presence of substandard care and severe injuries. Because of the time delay between occurrence of an injury and its appearance within the database (estimated at 3–6 yr), the influence of new technology and training on liability, such as use of fiberoptic bronchoscopy, the intubating LMA, and other new airway management tools, cannot be fully evaluated. Although closed claims analysis is useful for generating hypotheses about the mechanism and prevention of injuries related to airway management, it cannot be used for testing of those hypotheses. As a retrospective study, it cannot establish cause-and-effect relations between preceding events or changes in practice with the same degree of scientific strength or certainty as studies that use prospective data acquisition and rigorous internal controls.

Perioperative Claims

Death or brain damage for claims associated with induction of anesthesia was decreased in 1993–1999 compared with 1985–1992 (table 3). The almost quarter reduction in the odds of death/BD (odds ratio, 0.26; 95% confidence interval, 0.11–0.63; $P = 0.003$) may reflect improved difficult airway management with adoption of the 1993 Difficult Airway Guidelines.[2] These trends may also reflect improved safety with widespread use of new airway devices, such as the LMA, fiberoptic intubation, or awake intubation techniques. Alternately, the differences we observed may reflect changing legal strategies.

In contrast to induction of anesthesia, the proportion of death/BD in claims for difficult airway management during the maintenance, emergence, and recovery periods did not differ significantly with time periods (table 3). Although management approaches for difficult airways during maintenance and emergence were briefly described within the 1993 Difficult Airway Guidelines,[2] the algorithm pertains predominantly to induction of anesthesia. Our closed claims findings reinforce the recommendation of the Difficult Airway Guidelines,[2,6] that use of a local anesthetic or regional nerve block does not obviate the need for a strategy for intubation of the difficult airway. Our findings also support the need for a preformulated airway management plan, such as use of a rigid device (*e.g.*, gum elastic bougie or tube changer) to facilitate reintubation, if reintubation is required,[2,6] especially in the presence of a difficult intubation on induction, obesity, and/or sleep apnea. Further attention should be directed toward these periods of risk in the next update of the Difficult Airway Guidelines.

Awake intubation has been advocated as the safest technique to secure the airway in a cooperative patient

for a difficult airway.[7] However, we found poor outcomes in two clinical scenarios of awake intubation: sedation/airway instrumentation in the presence of pharyngeal infection or induction of anesthesia after unsuccessful attempts at awake intubation due to technical problems or lack of patient cooperation. Surgeons should be in the operating room and ready to perform an emergency surgical airway in these challenging cases so there is no delay. Further attention should also be paid to these problem areas in the next update of the Difficult Airway Guidelines.

Outside Location Claims

In contrast to perioperative claims, claims for care outside the perioperative period were all associated with death/BD. Although airway injuries may have been present in the outside location claims, the claim was filed for the more severe injury. The poorer outcome may reflect the lack of operating room resources of standard airway management equipment or the lack of immediate availability of healthcare providers skilled in airway management. Alternatively, it may reflect different litigation strategies in the emergency setting. However, there was no difference in the appropriateness of care, the proportion of payments made, or the median payment between perioperative and outside location claims.

Perioperative Airway Emergencies

Persistent intubation attempts were associated with an outcome of death/BD in claims in which a perioperative "cannot ventilate and cannot intubate" emergency situation developed. Although we cannot rule out outcome bias,[8] our data suggest that repeated attempts at intubation may adversely affect patient outcome and are consistent with increased airway and hemodynamic complications with multiple laryngoscopic attempts.[9] Our data also support the recommendations to limit conventional intubation attempts to three before using other strategies.[2,6,9]

The LMA was used as a successful bridge to secure the airway in five claims since 1993 in which an airway emergency did not develop. The utility of the LMA or intubating LMA in providing rescue ventilation in the management of simultaneous difficulty with mask ventilation and tracheal intubation is well described.[10–12] It is likely that there were multiple cases of airway emergencies in which the LMA was effective and thus never made it into the Closed Claims database. However, the Closed Claims data emphasize that failures of the LMA and Combitube® may occur, and they cannot be considered fail-safes for the difficult airway, particularly when there is infraglottic obstruction.[11] Our data suggest that the rescue ability of the LMA or Combitube® may have been reduced by the effects of multiple preceding attempts at conventional intubation.

In many of the emergency situations, emergency needle cricothyrotomy was attempted but was not successful in providing ventilation and caused barotrauma with death/BD. Our claims showing death/BD with transtracheal jet ventilation are also consistent with reports of high complication rates when this technique is used for rescue ventilation in the emergency setting,[11] when the technique is performed by inexperienced personnel, or when upper airway obstruction exists.[13]

In two thirds of the claims where an airway emergency occurred, a surgical airway was obtained but was too late to avoid poor outcomes. For a surgical airway to be successful as a rescue option, it must be instituted early in the management of the difficult airway. Prompt calls for the appropriate equipment and personnel may save lives.

Role of Difficult Airway Guideline in Litigation

The ASA Difficult Airway Guidelines[2] did not seem to play a major role in the outcome of litigation. The Guidelines were discussed in only 18% of the claims from 1993 to 1999 and were useful to both defense and plaintiff. The limited importance of the Guidelines in the litigation process may be due to their reflection of usual and standard practice patterns. In other areas of medicine, guidelines have been shown both to strengthen and weaken the defense of the practitioner.[14,15]

In conclusion, death/BD in claims arising from difficult airway management associated with induction of anesthesia, but not other phases of anesthesia, decreased in 1993–1999 compared with 1985–1992. Development of additional management strategies for difficult airways encountered during maintenance, emergence, or recovery from anesthesia may improve patient safety.

The authors thank Lynn Akerlund for her expert secretarial assistance and Pauline Cooper, B.S., and John Campos, M.A., for technical assistance. They are members of the Closed Claims Project research staff in the Department of Anesthesiology at the University of Washington, Seattle, Washington. The authors also thank the members of the American Society of Anesthesiologists who served as reviewers for the Closed Claims Project. A list of reviewers is available from the authors. The following organizations gave permission for acknowledgments as a source of closed claims: Anesthesia Service Medical Group, Inc., San Diego, California; Anesthesiologists' Professional Assurance Company, Coral Gables, Florida; Armed Forces Institute of Pathology, Silver Spring, Maryland; Risk Management Foundation, Cambridge, Massachusetts; COPIC Insurance Company, Denver, Colorado; The Doctors' Company, Napa, California; Daughters of Charity National Health System, St. Louis, Missouri; Illinois State Medical Inter-Insurance Exchange, Chicago, Illinois; Medical Professional Mutual Insurance Company, Boston, Massachusetts; Medical Association of Georgia Mutual Insurance Company, Atlanta, Georgia; Medical Liability Mutual Insurance Company, New York, New York; Medical Mutual Insurance Company of Maine, Portland, Maine; Midwest Medical Insurance Company, Minneapolis, Minnesota; Mutual Insurance Company of Arizona, Phoenix, Arizona; National Capital Reciprocal Insurance Company, Washington, D.C.; NORCAL Mutual Insurance Company, San Francisco, California; Pennsylvania Medical Society Liability Insurance Company, Mechanicsburg, Pennsylvania; Physicians Insurance A Mutual Company, Seattle, Washington; Physicians Insurance Company of Wisconsin, Madison, Wisconsin; Preferred Physicians Medical Risk Retention Group, Shawnee Mission, Kansas; State Volunteer Mutual Insurance Company, Brentwood, Tennessee; University of Texas Medical System, Austin, Texas; Utah Medical Insurance Association, Salt Lake City, Utah; and Department of Veterans Affairs, Washington, D.C.

References

1. Caplan RA, Posner KL, Ward RJ, Cheney FW: Adverse respiratory events in anesthesia: A closed claims analysis. ANESTHESIOLOGY 1990; 72:828–33

2. American Society of Anesthesiologists Task Force on Management of the Difficult Airway, Caplan RA, Benumof JL, Berry FA, Blitt CD, Bode RH, Cheney FW, Connis RT, Guidry OF, Ovassapian A: Practice guidelines for management of the difficult airway: A report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. ANESTHESIOLOGY 1993; 78: 597–602

3. Cheney FW: The American Society of Anesthesiologists Closed Claims Project: What have we learned, how has it affected practice, and how will it affect practice in the future? ANESTHESIOLOGY 1999; 91:553–6

4. Cheney FW, Posner K, Caplan RA, Ward FJ: Standard of care and anesthesia liability. J Am Med Assoc 1989; 261:1599–603

5. Posner KL, Sampson PD, Caplan RA, Ward FJ, Cheney FW: Measuring interrater reliability among multiple raters: An example of methods for nominal data. Stat Med 1990; 9:1103–15

6. American Society of Anesthesiologists Task Force on Management of the Difficult Airway,Caplan RA, Benumof JL, Berry FA, Blitt CD, Bode RH, Cheney FW, Connis RT, Guidry OF, Nickinovich DG, Ovassapian A: Practice guidelines for management of the difficult airway: An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. ANESTHESIOLOGY 2003; 98:1269–77

7. Benumof JL: Management of the difficult adult airway: With special emphasis on awake tracheal intubation. ANESTHESIOLOGY 1991; 75:1087–110

8. Caplan RA, Posner KL, Cheney FW: Effect of outcome on physician judgments of appropriateness of care. JAMA 1991; 265:1956–60

9. Mort TC: Emergency tracheal intubation: Complications associated with repeated laryngoscopic attempts. Anesth Analg 2004; 99:607–13

10. Benumof JL: Laryngeal mask airway and the ASA difficult airway algorithm. ANESTHESIOLOGY 1996; 84:686–99

11. Parmet JL, Colonna-Romano P, Horrow JC, Miller F, Gonzales J, Rosenberg H: The laryngeal mask airway reliably provides rescue ventilation in cases of unanticipated difficult tracheal intubation along with difficult mask ventilation. Anesth Analg 1998; 87:661–5

12. Combes X, Le Roux, B, Suen P, Dumerat M, Motamed C, Sauvat S, Duvaldestin P, Dhonneur G: Unanticipated difficult airway in anesthetized patients. ANESTHESIOLOGY 2004; 100:1146–50

13. Eisenburger P, Laczika K, List M, Wilfing A, Losert H, Hofbauer R, Burgmann H, Bankl H, Pikula B, Benumof JL, Frass M: Comparison of conventional surgical versus Seldinger technique emergency cricothyrotomy performed by inexperienced clinicians. ANESTHESIOLOGY 2000; 92:687–90

14. Hyams AL, Shapiro DW, Brennan TA: Medical practice guidelines in malpractice litigation: An early retrospective. J Health Polit Policy Law 1996; 21: 289–313

15. Hyams AL, Braidenburg JA, Lipsitz SR, Shapiro DW, Brennan TA: Practice guidelines and malpractice litigation: A two way street. Ann Intern Med 1995; 122:450–5