



Original Contributions

Perianesthetic Dental Injuries: Analysis of Incident Reports

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Study Objective: *To conduct a retrospective analysis of incident reports concerning dental injury, the most common cause for litigation against anesthesiologists, to determine specific risk factors that will help in formulating a risk reduction strategy for this clinical problem.*
Design: *Retrospective chart review of a large professional liability insurer.*

Interventions: *Of 40 hospitals that report to the MRM Co. as part of the professional liability insurance, during the years 1992-1999, 18 hospitals reported dental injury. A Maxillofacial surgeon (GN) and an anesthesiologist (ES), using a structured form, reviewed the reports. Evaluation of the cost of injury was determined from the patient's claims or from an evaluation of rehabilitation plan constructed by the maxillofacial surgery consultants to the company.*

Measurements and Main Results: *There were 203 incidents due to dental injury. The patients were most commonly in their 5th to 7th decade. Eighty six percent of the injured teeth were the upper incisors. Lower incisors were more likely to be injured during an urgent intubation, or due to airway manipulation other than intubation. (i.e., oral airway insertion) In only 38 (18.6%) cases was there a previous assessment of an expected difficult intubation. Dentition was judged to be pathological in 32% of the patients.*

Conclusions: *In elective intubation, the teeth most likely to be injured are the upper incisors, in patients aged 50–70 years. In most cases dental injury is not associated with a pre-event prediction of difficult intubation.* © 2004 by Elsevier Inc.

Keywords: Anesthesia; general; intubation; complications; dental trauma; dental injury.

Introduction

Dental injury is a common perianesthetic event. Trauma may occur during laryngoscopy, or from the use of oropharyngeal airways, mouth openers, props, and gags. The incidence of perianesthetic dental injury (PDI) varies from 0.04% to 12.08%,¹ and is considered to be the most frequent anesthesia-related cause for claims, representing approximately one third of all confirmed claims.² The sequelae of PDI may place a strain on the doctor-patient relationship, involve irreparable, costly, and sometimes even life-threatening injuries to the patient,

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and even result in litigation against the anesthesiologist or the health care institution.

The purpose of this study was to determine the characteristics and outcomes of PDI in a large multi-institutional risk management database of adverse event reports, to conduct evidence-based risk management that will reduce PDI and their related sequelae and costs.

Materials and Methods

The Medical Risk Management Company Ltd. (MRM) as part of their professional liability insurance scheme, collects incident reports from 31 medical institutions in Israel in which general anesthesia is administered. The reports may be initiated by the hospital staff (primary source) or as a result of patient complaint (secondary source), and they are sent to MRM by the local risk management team. In the present study, all events regarding PDI that were reported between 1992 and 1998 were included. A total of 203 reports were analyzed, according to the evaluation form, for patient demographics, intubation characteristics such as type (oral/nasal), elective or emergency, and difficulty of intubation as assessed pre-intubation and post-intubation.

Dental parameters included assessment of previous dental treatment. Preexisting pathology was evaluated from reports of the treating dentist following the event and from radiological studies of dentition. The type and severity of injury was evaluated from dental records of the treating dentist. Treatment required and cost of therapy was obtained from the dental surgeons whom the patients consulted to restore the damage. In cases in which the patient did not request compensation, a tentative treatment plan and its cost were evaluated by the MRM dental consultants.

A *t*-test was performed to compare the teeth damaged with different intubation types. A *p*-value of less than 0.05 was considered significant.

Results

Between the years 1992 to 1998 a total of 203 incidents of PDI were reported. Of the 203 patients representing these incidents, 98 were females and 105 were males. Age ranged between 8 to 90 years (mean 53 yrs).

Most of the patients (72%) were in the 5th to 7th decade of life. Of the patients, 77% were ASA physical status I and II, 17% were graded ASA III, and 6% were graded ASA IV. One hundred eighty of the procedures were performed in the operating room (OR). Of these, 158 were elective intubations and 20 were related to laryngeal mask airway, oral airway, or direct laryngoscopy. In 25 patients, the report dealt with emergency intubations, some of which were performed outside the OR.

The institutions involved in incident reporting in this series were diverse in size, type of practice, and quantity of surgical and anesthetic activity. No reports were derived from medical institutions with fewer than 40 beds. Incidence could not be calculated since surgical activity for the time period studied was unknown. Preoperative assess-

Table 1. Location of Injured Teeth in Relation to Type of Intubation

Intubation	Upper Teeth (%)	Lower Teeth (%)	Total (%)
Elective	151 (95.6)	7 (4.4)	158 (100)
Emergency	20 (80)	5 (20)	25 (100)
Other*	7 (35)	13 (65)	20 (100)
Total	178 (87.7)	25 (12.3)	203 (100)

*Other-direct laryngoscopy, Laryngeal Mask Airway, or oral airway.

ment was similar in all hospitals. Despite this fact, the preoperative assessment form is not standard, and different departments of anesthesia use different forms that do not emphasize dentition to the same extent.

The elective intubations were assessed preoperatively and postoperatively as easy or difficult. Of 86 intubations that were assessed as difficult postoperatively, only 30 (35%) were assessed as such preoperatively.

In 62 cases (34.4%), preoperative suspicion for PDI was recorded in the anesthetic chart.

Preoperative suspicion of an increased risk for PDI was documented in 50% of the patients with dental pathology. Of the PDI patients without preexisting dental pathology, only 16.5% were documented to have a potential risk of PDI ($p < 0.001$). One hundred nine cases were reported from medical institutions with maxillofacial or dental services, yet no consultation with a dentist or dental surgeon was made in any of the cases prior to anesthesia. In only 26.6% was a post-injury consultation or treatment obtained.

The most common injury was to the upper incisors of 87.0%. The lower incisors were injured in only 12.5% of the cases.

The distribution of type of teeth injured according to the type of intubation is presented in *Table 1*. When the cause of injury was other than intubation, i.e., direct laryngoscopy, Laryngeal Mask Airway, or oral airway, 35% of the teeth injured were lower ones, i.e., located in the mandible.

In emergency intubations, 20% of the teeth were mandibular teeth and in elective intubations 4.4% of the teeth were mandibular ($p < 0.001$). One hundred seventy cases were reported by the hospital staff, anesthesiologists, and nurses. Thirty-four of the reports to the insurance company were initiated by patient complaint. Lower teeth comprised 18% of patients' complaints and only 11% from the staff reports ($p < 0.001$).

Exfoliation of teeth was the most common type of injury (48%), followed by crown fracture (22%), root fracture (19%), damage to crown, and bridgework (18%), and extensive tooth mobility (12%). Most of the injured teeth (65%) could not be restored, according to the assessment of a dental surgeon (N.G.).

Discussion

The incidence of dental injury during anesthetic management is significant and has been estimated at between

0.04% to 12%.¹ Warner *et al*³ evaluated 598,904 patients prospectively over a period of 10 years. They asked patients 7 days after they received anesthesia about damage to the teeth and found 132 cases, leading to an incidence of 1:4537. The report identified a number of risk factors for injury to the teeth, including general anesthesia, history of difficult intubation, previous head and neck surgery, presumably as a marker of difficult intubation. Fung and Chan⁴ prospectively assessed 404 surgical procedures performed during general anesthesia with endotracheal intubation. They found 28 patients with oral trauma, providing an incidence of 6.9%, including soft tissue trauma. Another large prospective study conducted over 10 years in a single institution in Copenhagen found 75 cases of dental injury from 120,086 anesthetic procedures (0.06%), even when mouthguards were used.⁵ The large variation in incidence may be due to the technique by which the cases of PDI are located, i.e., whether patients were actively queried about possible injury to teeth or apparent loss of teeth was noted by the clinician caring for the patient. The major risk factor for dental injury in our cases was preexisting poor dentition. This factor implicated 95 of the 180 cases. A second risk factor was intubation difficulty. This factor was noted in 86 cases; however, in only 30 case was the intubation prospectively predicted to be difficult.

Dental injuries occurred primarily in the age group between 50 and 70 years, which is probably a result of the higher incidence of periodontal disease in this age group. Younger patients have better dentition for the most part, and therefore are less prone to significant injury, even when force is applied to the teeth. Older patients frequently have complete or partially removable dentures and are, therefore, also less prone to damage.

Many of the hospitals that reported dental injury have an active maxillofacial or dental service. It is interesting to note, therefore, that in none of the cases were these services consulted before surgery. Even more surprising was the fact that of the 109 patients reported from hospitals with dental services, only 29 cases generated a consultation from these services, even after damage to the teeth was recognized. One mechanism to improve care and awareness of potential health hazards is an active risk management program. All institutions that are part of this series have an active risk management program as part of their health liability coverage. Despite this fact, there is a large variability in the awareness of the different institutions with regard both to preoperative assessment and incident reporting. This situation is exemplified by the fact that there were no reports from institutions with fewer than 40 beds.

While we feel that the approach advocated by Chadwick,¹ who proposed that all patients undergoing general anesthesia be evaluated by a dental surgeon preoperatively, is impractical, there is certainly an important role for preoperative evaluation in selected cases. In some cases, this assessment would enable corrective or protective measures, as well as documentation of the patient's dentition, which may be important in cases of litigation.

When injury has occurred, a dental consult may reduce damage. Early treatment by a dental surgeon should include an attempt at reimplantation or fixation of teeth that were loosened due to trauma during intubation.

The primary determinant of success of reimplantation after traumatic extraction is the time that elapsed between avulsion and reimplantation. When the reimplantation is performed within 30 minutes, the success rate has been reported to be as high as 90%.⁶ It is, therefore, important to involve the dental surgeons as early as possible if permanent damage is to be minimized.

The financial implications of dental injury during anesthesia are significant. The costs of restoring the 203 PDI in our series was estimated to be around \$400,000, or approximately \$2000 per patient. Reports have described dental injury as the most common complication of intubation.⁷ Although most cases involve relatively small claims (or assessment of injury), the frequency of these events is such that the total cost is substantial.

Limitations of the Study

Our study cannot provide data about incidence because we do not know the total number of anesthetics delivered in these institutions during this time period. Moreover, our analysis is derived from incident reports, which are dependent on the awareness of the clinicians in each particular institution.

A preoperative structured form to assist in evaluation and documentation of the patient's dental status before general anesthesia has been proposed.⁸ It may be that such an approach can reduce the lack of documentation of prior dental disease, which was often missing from the initial incident reports in our cases. Better documentation can improve provision of information to patients before anesthesia, and possibly also reduce liability. Current practice with regard to structured preoperative assessment of dental status is variable, with some hospitals devoting some questions about dentition in a general way, and other hospitals requiring a more in-depth evaluation of dentition as part of the routine assessment. From our series, it may be concluded that a standard form emphasizing dental status may be important for diagnosing these patients.

Our series is derived from incident reports from a risk management program of a large health liability insurer. By analyzing a large group of incidents regarding PDI, we found, as others have before us, that poor dentition and a difficult intubation are the most significant risk factors for PDI. The value of incident reporting as a tool to provide information regarding risk factors for adverse outcomes is thus reinforced.

In conclusion, PDI constitute a significant burden on anesthesia practice both in terms of patient morbidity and cost. Preoperative assessment, with dental consultation when appropriate, may reduce damage to patients, as well as help contain financial costs to the medical institutions.

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