Dental injuries caused by endotracheal intubation - A retrospective study

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Abstract

Objective: Dental injury is the most common complication of general anaesthesia. The primary purpose of this study was to report the occurrence, location, type, and treatment of dental injury caused by endotracheal intubation.

Methods: This retrospective study evaluated 36,627 cases of general anaesthesia at our hospital from January 2008 through December 2015. The examination items included risk factors such as age; sex; surgical department; type of intubation(orotracheal or nasotracheal intubation) ; presence of preoperative trismus; Cormack–Lehane classification; experience of the attending anaesthesiologist; intubation appliance; mouth guard use; tooth mobility diagnosed by attending anaesthesiologist before surgery; the location, type, and treatment of injured teeth; and forensic implications.

Results: The incidence of dental injury was 0.06% (22 of 36,627 patients). There was a significant difference in the rate of dental injury according to age (0.026% among those <60 years of age vs. 0.096% among those ≥60 years; $P < 0.05$) and according to surgical department (0.189% among neurosurgery patients; $P < 0.05$). The most common Cormack–Lehane classification of laryngeal view in the 22 patients with dental injury was grade 2 (50%). Tooth mobility was diagnosed by anaesthesiologists in 50% of injured patients before surgery. There was no preoperative dental consultation in our department in any of the patients with injured teeth.

Conclusions: Dental screening is recommended for patients in whom anaesthesiologists find mobile teeth and difficult intubation. A system to facilitate cooperation between anaesthesiologists and dental surgeons should be established.

Keywords: dental injury; complication; general anaesthesia; endotracheal intubation

1. Introduction

Traumatic dental injury is one of the most frequent complications of endotracheal intubation during general anaesthesia [1, 2]. The most common forms of dental injury are crown and root fractures, followed by dislocations and avulsions [3]. The reported incidence of dental injury is 0.02% to 0.07% in retrospective studies [4-7], but 12.1% to 25% in prospective studies [8, 9]. One of likely reasons for this discrepancy between retrospective and prospective studies is underestimation of dental injury following general anaesthesia. Notably, a previous large case-control study found that 14% of dental injury was discovered by the patients themselves [7].

To decrease the incidence of dental injury related to endotracheal intubation, understanding the risk factors and methods of tooth protection is essential. Poor dentition, intubation difficulty, and alternative airway device use are reported risk factors [7, 10]. A case-control study reported that the incidence of dental injury was higher in the ear, nose, and throat department compared with other surgical departments [10]. Although dental trauma caused by direct small-force contact with the laryngoscope blade is considered preventable with mouth guard placement, only 2% of anaesthesiologists use dental shields [11].

When dental injury occurs during general anaesthesia, dental surgeons are called for treatment. Therefore, dental surgeons should understand the pathology of dental injury

occurring during general anaesthesia. The objective of this study was to investigate the occurrence, location, type, and treatment of dental injury caused by endotracheal intubation.

Materials and methods

This study included all patients who underwent general anaesthesia at our hospital from January 2008 to December 2015. The following data from these 36,627 cases were collected by reviewing the self-reported anaesthesia chart of the anaesthesiologist and computerized medical records: age; sex; surgical department; type of intubation(orotracheal or nasotracheal intubation); trismus diagnosed by attending anaesthesiologist before surgery; Cormack–Lehane classification of laryngeal view (grade 1, full glottis exposure; grade 2, only the posterior commissure of the glottis seen; grade 3, no exposure of the glottis; grade 4, no exposure of the glottis or the corniculate cartilages) [12]; experience of attending anaesthesiologist; intubation appliance; mouth guard use; tooth mobility diagnosed by attending anaesthesiologist before surgery; the location, type, and treatment of injured teeth; and forensic implications. Traumatic dental injury following general anaesthesia was defined as a change in dental status requiring dental consultation for repair of dental injury.

Statistical analyses were performed with R software (R Development Core Team, 2011). The χ^2 test and Student's t test were performed. A value of $P < 0.05$ was considered to indicate statistical significance.

Results

The 36,627 patients who underwent general anaesthesia included 22 registered cases of dental injuries (12 in males, 10 in females), corresponding to an incidence of 0.06%. The patient age distribution is shown in Figure 1. There was a significant difference in the occurrence rate of dental injury during general anaesthesia according to patient age (0.026% among those <60 years of age vs. 0.096% among those ≥60 years; $P < 0.05$). There was no significant difference in occurrence by sex (0.061% in males vs. 0.059% in females). The incidence of dental injury caused by intubation was significantly higher in neurosurgery (0.189%, $P < 0.05$) and paediatric surgery (0.862%, $P < 0.05$) than in other surgical departments (Table 1). Mouth guards were used in 354 patients (0.97%); none of these patients experienced dental injury.

Among the 22 patients with dental injury, two (9%) underwent nasal intubation, four (18%) had trismus. The most common Cormack–Lehane classification of laryngeal view in these 22 patients was grade 2 (50%). Most of the anaesthesiologists in these cases were residents (68%). The most common intubation tool used in these 22 patients was a Macintosh laryngoscope (62%; Table 2).

Table 3 shows the location, type, and treatment of injured teeth. The most common location of dental injury was the maxillary left central incisor (50%). In 11 of 22 patients with

dental injury (50%), tooth mobility was diagnosed by anaesthesiologists before surgery. The most common types of dental injury were avulsion (36%) and luxation (36%). Twenty-three percent of patients underwent extraction of the injured tooth. Forty-five percent of patients underwent only reinstallation of a bridge or observation. In all injured teeth with only slight luxation, observation alone was performed. There were two forensic implications (9%).

Discussion

The main goal of this retrospective study was to investigate the occurrence of traumatic dental injury during anaesthesia. The incidence of dental injury resulting from endotracheal intubation was 0.06% in this retrospective study, similar to previous retrospective studies [4-7].

We found that dental injury occurred significantly more frequently in neurosurgery and paediatric surgery than in other surgical departments. However, dental injury in paediatric surgery occurred in only one patient in this study. The risk of dental injury in neurosurgery patients is known to be higher because of prone patient positioning for back operations [3]. Ham et al. reported that more of the patients who experienced dental injury had neurological disease than patients who did not incur dental injury [10]. Previous studies have reported a high risk of dental injury in cardiothoracic surgery [3, 10]. Vogel et al. noted that this increased risk could be attributed to the use of a double-lumen tube in these patients

[3]. Ham et al. indicated that the comparatively lower incidence of dental injury in their cardiothoracic surgery department reflected a recent trend of using smaller and more flexible double-lumen tubes than those previously used [10]. There were no dental injuries in the cardiothoracic surgery department in the present study. Another department with a comparatively high frequency of dental injury is ear, nose, and throat surgery, because of surgical procedures requiring airway instrumentation [10]. There were no dental injuries in the otolaryngology-head and neck surgery department in this study. Mouth guards were used in 0.97% of intubated patients in this study; all of these patients underwent laryngoscopic surgery. Mouth guards can help prevent dental injury by distributing forces uniformly over the dentition. The drawback of mouth guards is that their thickness decreases the space within the oral cavity, leading to poor visualization and increased difficulty in guiding the endotracheal tube into the larynx [13]. The use of mouth guards has no significant effect on the incidence of dental injury; however, mouth guard use is recommended, especially for bronchoscopic and endoscopic surgeries in which a rigid scope is used [14].

In this study, a conventional laryngoscope (Macintosh) was used in 64% of patients with dental injury. Mourão et al. reported the high incidence of dental damage following conventional direct laryngoscopy [9]. A reported average force of 49 N is applied to the maxillary incisors during conventional direct laryngoscopy in adult patients [15]. The maxillary incisors are at greatest risk for damage, because they are frequently used as a

fulcrum [2]. Comparison of the incidence of dental injury with the use of conventional laryngoscope versus other intubation devices, such as videolaryngoscopes, is needed. In a study evaluating intubation difficulty in maxillofacial surgery patients, the Cormack–Lehane classification (greater than grade 3) had the highest sensitivity and positive predictive value in predicting intubation difficulty [16]. In the present study, 50% of dental injury occurred in patients diagnosed as Cormack–Lehane grade 2. This result might be explained by the assumption that dental injuries during intubation in this study were caused more by poor dentition than intubation difficulty.

The most common site of dental injury in this study was the maxillary left central incisor (50%), similar to the findings of a previous study [3]. This finding can be attributed to the fact that the left hand is used to move the tongue to the left side with the laryngoscope to view the glottis in conventional laryngoscopy [3]. To the best of our knowledge, few studies have been performed on the treatment and outcome of dental injury during general anaesthesia. In the present study, 23% of patients with dental injury underwent extraction. The injured teeth with only slight luxation were observed without fixation. Further studies concerning adequate treatment of dental injury caused by intubation are necessary.

There is no preoperative dental consultation in our department. However, anaesthesiologists diagnosed tooth mobility prior to surgery in 50% of patients with dental injury during intubation. It does not seem practical to perform preoperative dental screening

in all patients undergoing surgery under general anaesthesia. However, dental screening is recommended in patients in whom anaesthesiologists find mobile teeth and difficult intubation (e.g., patients with trismus). A system to facilitate cooperation between anaesthesiologists and dental surgeons should be established.

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Competing interests

None declared.

Ethical approval

Not required.

References

1. Nouette-Gaulain K, Lenfant F, Jacquet-Francillon D, Belbachir A, Bournigault-Nuquet A, Choquet O, et al. French clinical guidelines for prevention of perianaesthetic dental injuries: long text. Ann Fr Anesth Reanim 2012;31:213-23.

2. Gaudio RM, Barbieri S, Feltracco P, Tiano L, Galligioni H, Uberti M, et al. Traumatic dental injuries during anaesthesia. Part II: medico-legal evaluation and liability. Dent Traumatol 2011;27:40-5.

3. Vogel J, Stübinger S, Kaufmann M, Krastl G, Filippi A. Dental injuries resulting from tracheal intubation--a retrospective study. Dent Traumatol 2009;25:73-7.

4. Folwaczny M, Hickel R. Oro-dental injuries during intubation anesthesia. Anaesthesist 1998;47:707-31.

5. Warner ME, Benenfeld SM, Warner MA, Schroeder DR, Maxson PM. Perianesthetic dental injuries: frequency, outcomes, and risk factors. Anesthesiology 1999; 90:1302-5.

6. Owen H, Waddell-Smith I. Dental trauma associated with anaesthesia. Anaesth Intensive Care 2000;28:133-45.

7. Newland MC, Ellis SJ, Peters KR, Simonson JA, Durham TM, Ullrich FA, et al. Dental injury associated with anesthesia: a report of 161,687 anesthetics given over 14 years. J

Clin Anesth 2007;19:339-45.

8. Chen JJ, Susetio L, Chao CC. Oral complications associated with endotracheal general anesthesia. Ma Zui Xue Za Zhi 1990;28:163-9.

9. Mourão J, Neto J, Luís C, Moreno C, Barbosa J, Carvalho J, et al. Dental injury after conventional direct laryngoscopy: a prospective observational study. Anaesthesia 2013;68:1059-65.

10. Ham SY, Kim J, Oh YJ, Lee B, Shin YS, Na S. Risk factors for peri-anaesthetic dental injury. Anaesthesia 2016;71:1070-6.

11. Monaca E, Fock N, Doehn M, Wappler F. The effectiveness of preformed tooth protectors during endotracheal intubation: an upper jaw model. Anesth Analg. 2007;105:1326-32.

12. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia 1984;39:1105-11.

13. Yasney JS. Perioperative dental considerations for the anesthesiologist. Anesthe Analg 2009;108:1564-73.

14. Skeie A, Schwartz O. Traumatic injuries of the teeth in connection with general anaesthesia and the effect of use of mouthguards. Endod Dent Traumatol 1999;15:33-6.

15. Buck MJ, Snijders CJ, van Geel RT, Robers C, van de Giessen H, Erdmann W, et al. Forces acting on the maxillary incisor teeth during laryngoscopy using the Machintosh laryngoscope. Anaesthesia 1994;49:1064-70.

16. Tuzuner-Oncul AM, Kucukyavuz Z. Prevalence and prediction of difficult intubation in maxillofacial surgery patients. J Oral Maxillofac Surg 2008;66:1652-8.

Figure captions

Fig. 1. Age distribution of patients experiencing dental injury caused by intubation during general anaesthesia (n = 22).

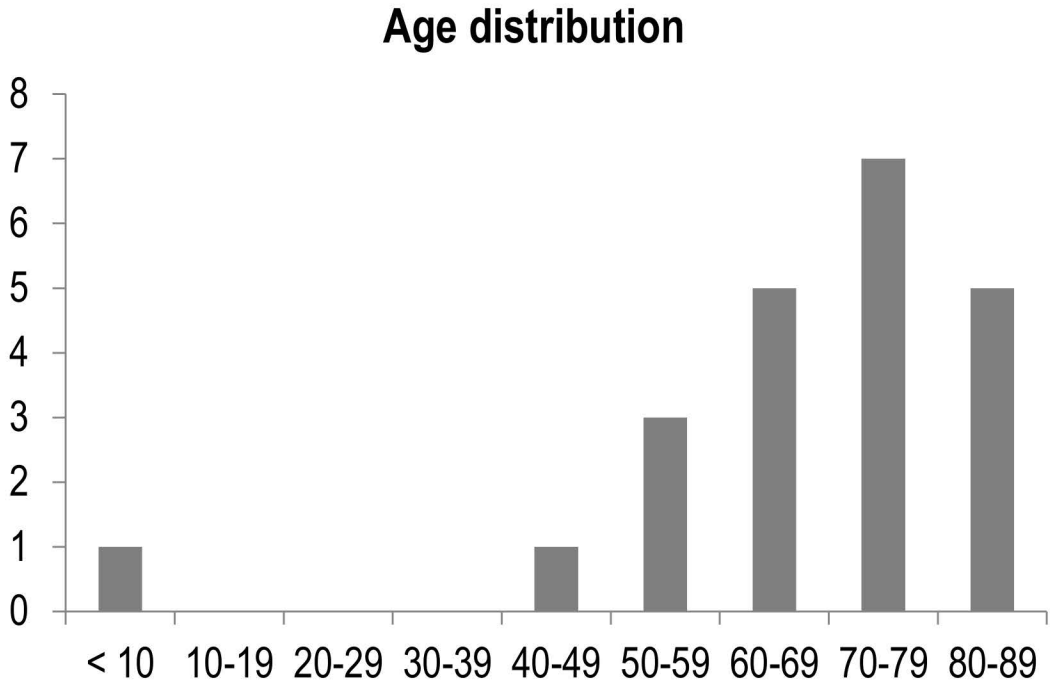
Age distribution
8
7
6
5
4
3
2
1
0
< 10
10-19
20-29
30-39
40-49
50-59
60-69
70-79
80-89

Figure 1

Table 1 Calculated risk of dental injury during general anaesthesia in different departments

Surgical department	Number of intubation (%)	Patients experiencing dental injuries (%)	*P*
Orthopaedic	5671 (15.5)	4 (0.071)	NS
Gynaecology	4024 (11)	1 (0.024)	NS
Urology	3495 (9.5)	3 (0.086)	NS
Gastroenterological surgery	2761 (7.5)	4 (0.145)	NS
Plastic surgery	2429 (6.6)	1 (0.041)	NS
Hepato-Billary-Pancreatic surgery	2368 (6.5)	2 (0.084)	NS
Neurosurgery	2111 (5.8)	4 (0.189)	<0.05
Oral and Maxillofacial surgery	1760 (4.8)	2 (0.114)	NS
Paediatric surgery	116 (0.3)	1 (0.862)	<0.01

Table 2 Factors studied and intubation tools used in 22 patients with dental injury

	Number of patient (%)
Trismus	
Yes	4 (18)
No	18 (82)
Cormack–Lehane classification	
1	8 (36)
2	11 (50)
3	3 (14)
Experience of anaesthesiologists	
Rotator	3 (14)
Resident	15 (68)
Expert	4 (18)
Intubation tool	
Macintosh	14 (64)
Videoscopic	6 (27)
Fibreoptic	2 (9)

Table 3 Location, type, and treatment of injured teeth

	Injured tooth (n = 22)					
	Maxillary left central incisor (n = 11, 50%)	Maxillary right central incisor (n = 4, 18%)	Maxillary anterior bridge (n = 3, 14%)	Bilateral maxillary central incisors (n = 2, 9%)	Deciduous teeth (bilateral mandibular central incisors) (n = 1, 4.5%)	Maxillary left first premolar (n = 1, 4.5%)
Preoperative tooth mobility[a] (n = 11, 50%)	7	2	1	-	-	1
Type						
Avulsion (n = 8, 36%)	5	2	1	-	-	-
Luxation (n = 8, 36%)	4	1	1	1	1	-
Fracture (n = 3, 14%)	1	1	-	1	-	-
Dislocation[b] (n = 3, 14%)	1	-	1	-	-	1
Treatment						
Extraction (n = 5, 23%)	1	1	1	-	1	1
Tooth fixation (n = 4, 18%)	2	-	1	1	-	-
Restoration with composite resin (n = 3, 14%)	1	1	-	1	-	-
					-	-
Others[c] (n = 10, 45%)	7	2	1	-	-	-
Forensic implication (n = 2, 9%)	1	-	-	-	-	1

[a] Tooth mobility diagnosed by anaesthesiologists before surgery

[b] Dislocation of prosthetic restorations

[c] Includes reinstallation of bridge or observation.