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Original Article

An Association of Predicted/Unpredicted Difficult Intubation with Fibreoptic Bronchoscopic Intubation

Öngörülen ve Öngörülemeyen Zor Entübasyon ile Fiberoptik Bronkoskopik Entübasyon İlişkisi

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Abstract

Aim: Inadequate preoperative airway assessment is one of the most common causes of failed airway management and intubation. Fibreoptic bronchoscopic intubation (FBI) is an effective technique for creating airway access in patients with expected and unexpected difficult airways. The aim of this study is to evaluate the incidence of predicted difficult airway (DA) in patients intubated due to DA with FBI.

Materials and Methods: We retrospectively reviewed the medical records of one hundred and forty-three ASA I-V patients aged 0-80 years diagnosed with DA who underwent flexible FBI from January 2006 to December 2011. Age, weight, sex, concomitant syndromes, whether difficult intubation (DI) occurred after trauma, whether FBI was applied via nasal or oral ways, size of tube, whether FBI was successful or not and relationships of these parameters were analysed.

Results: The study involved 143 patients, 38 (22.2%) in the pediatric group and 105 patients (77.8%) in the adult group. Of the patients, 64 (47.4%) were female and 71 (52.6%) were male. 42 patients underwent DI for syndromes with craniofacial abnormalities. As a result of preoperative anaesthetic assessment, DI could be predicted in 74 patients (51.7%) by history, physical examination and Mallampati scoring, while unexpected DI occurred in 69 (48.3%) of patients. The proportion of predicted DA was much higher in children compared to adults.

Conclusion: It is not easy to check all predictors of DI in a pre-anaesthetic examination and the predictors are not accurate. Unexpected DI is not a rare occurrence in the operating room (OR). Despite a thorough pre-operative assessment, anaesthetists may not be able to predict what they will encounter during surgery and therefore should always be prepared for any challenge.

Keywords: Preoperative assessment, predicted difficult intubation, fiberoptik bronchoscopic intubation, syndromes with craniofacial abnormalities

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Öz

Amaç: Yetersiz preoperatif hava yolu değerlendirmesi, başarısız hava yolu yönetimi ve entübasyonun en yaygın nedenlerinden biridir. Fiberoptik bronkoskopik entübasyon (FBE), beklenen ve beklenmeyen zor hava yolu (ZHY) olan hastalarda hava yolu erişimi sağlamak için etkili bir tekniktir. Bu çalışmanın amacı, FBE ile ZHY nedeniyle entübe edilen hastalarda öngörülen zor havayolu insidansını değerlendirmektir.

Gereç ve Yöntemler: Ocak 2006'dan Aralık 2011'e kadar FBE uygulanan ZHY tanısı almış 0-80 yaşları arasındaki yüz kırk üç ASA I-V hastanın tıbbi kayıtları geriye dönük olarak incelendi. Yaş, kilo, cinsiyet, Mallampati skoru, eşlik eden sendromlar, travma sonrası zor entübasyonun (ZE) olup olmadığı, FBE'un nazal veya oral yoldan uygulanıp uygulanmadığı, FBE'un başarılı olup olmadığı ve bu parametrelerin ilişkileri analiz edildi.

Bulgular: Çalışmaya pediatrik grupta 38 (%22,2) ve erişkin grupta 105 hasta (%77,8) olmak üzere 143 hasta dahil edildi. Hastaların 64'ü (%47,4) kadın, 71'i (%52,6) erkekti. 42 hastada kraniyofasiyal anormallikleri olan sendromları nedeniyle ZE gerçekleşti. Preoperatif anestezik değerlendirme sonucunda 74 hastada (%51,7) öykü, fizik muayene ve Mallampati skorlaması ile ZE öngörülebilirken, 69 hastada (%48,3) beklenmedik ZE ortaya çıktı. Çocuklarda tahmin edilen ZHY oranı yetişkinlere göre çok daha yüksekti.

Sonuç: Pre-anestetik muayenede ZE'un tüm prediktörlerini kontrol etmek kolay değildir ve prediktörler yeterli değildir. Beklenmeyen ZE, ameliyathanede nadir görülen bir durum değildir. Kapsamlı bir ameliyat öncesi değerlendirmeye rağmen, anestezistler ameliyat sırasında neyle karşılaşacaklarını tahmin edemeyebilirler ve bu nedenle her zaman her türlü zorluğa hazırlıklı olmalıdırlar.

Anahtar Kelimeler: Preoperatif değerlendirme, öngörülen zor entübasyon, fiberoptik bronkoskopik entübasyon, kraniyofasiyal anomalileri olan sendromlar

Introduction

Anesthesiologists are responsible for airway management, which is a fundamental technique. One of the major causes of anesthesia-related morbidity and mortality is lack of preparation for difficult airway management [1]. It is critical for safe anesthesia care that the appropriate airway management technique is used for each individual patient [2].

DAs are situations in which an anesthesiologist encounters anticipated or unanticipated difficulties or failures, such as face mask ventilation, laryngoscopy, ventilation through the supraglottic airway, or tracheal intubation or extubation [3].

Murphy first described FBI in 1967, and its success rate is reported to be 88 to 100% [4]. According to some authors, it is still the gold standard for anticipating and treating DA [5]. Indirect laryngoscopy and supraglottic airway assist devices have dramatically changed airway management, leading to a decrease in the use of FBI [5,6].

Management of patients with DA, optimizing airway management success, improving patient safety during airway management, and minimizing/preventing adverse events. Death, brain injury, cardiopulmonary arrest, airway trauma, and dental damage are the most common adverse outcomes associated with DA. In anesthesia care and airway management, the appropriate combination of medications and techniques depends on the physician's experience, training, and preferences, as well as the patient's health status, the type of procedure, and the environment in which the procedure occurs [3].

The FBI continues to play a critical role in the management of DA, as it allows the anesthesiologist to plan a rescue strategy for an unanticipated DA and to have a plan in place in case of a predictable DA [7]. Children with expected DA have a very low prevalence. Successful management undoubtedly depends on the experience of the anesthesiologist. Using flexible endoscopes and maintaining spontaneous breathing, especially in children with anatomically defined airways, is now the preferred technique in children with anticipated DA [8].

The risk of DA management is determined by each anesthesiologist based on their experience. The more experience, the better the "data" available for inductive assessments, i.e., assessments based on previous experience. It is important to note that the risk of difficulty or failure in airway management is not absolute and that two anesthesiologists in the same clinical situation may recommend very different approaches [9].

The aim of this study was to investigate the frequency of predicted DA in patients intubated for DA with FBI.

Material and Methods

Retrospective anesthesia records of 143 patients aged 0-80 years who received general anesthesia for elective or emergency procedures and were intubated with the flexible FBI between January 2006 and December 2011 were included in the study. Patient records were analyzed with a prediction DA based on preoperative airway examination. Approval was obtained from the Hacettepe University institutional review board and ethics committee before the study began.

The study evaluated the patients' age, weight, sex, Mallampati score, presence of syndromes with craniofacial abnormalities, whether the DI situation was posttraumatic, whether FBI was nasal or oral, whether FBI was successful, and the correlation of these parameters with the other relationships.

Patients were divided into two groups according to age: Patients younger than 18 years were defined as the pediatric group, and patients aged ≥18 years were defined as the adult group. While diseases such as ankylosis of the temporomandibular joint (TMJ), mandibular hypoplasia, Pierre Robin syndrome, Treacher Collins syndrome, Goldenhar syndrome, cleft lip and palate are included in the diagnosis and procedure group of patients, difficulties occurring in diseases such as traffic accident, thyroidectomy, jaw trauma, abdominoplasty are evaluated in the group. A mouth opening of less than 3.8 cm was defined as restricted.

Appropriate premedication was administered to each patient before admission to OR. Anesthesia induction followed the same procedure for all patients, and standard anesthetic monitoring such as pulse oximetry, ECG, heart rate, noninvasive blood pressure, and adequate preoxygenation was performed. Anesthesia was induced by intravenous administration of 2-3 mg/kg propofol, 2 µ/kg fentanyl, and 0.6 mg/kg rocuronium to facilitate endotracheal intubation. Anesthesia was maintained by continuous infusion of 0.05-0.3 µ/kg/min remifentanil and inhaled sevoflurane at a concentration of 2-2.2%. A D olimpus LF-DP CEO197 (Japan) was used in pediatric patients, and a Karl Storz CEO 123 flexible fiberoptic broncoscope (Germany) was used in adult patients.

Using the American Society of Anesthesiologists guidelines (ASA), the anesthesiologist diagnosed DA under outpatient anesthesia clinic conditions. In reviewing the medical records, the following data were collected: Sex, age, causes for DA and success, and complications of the procedure. The anesthesia team had experience with DA and followed the same protocol for FBI. During the procedure, the bronchoscopist stood behind the patient's head, who was in the supine position. Supplemental oxygen (2-3 L/min-1) was delivered via a nasopharyngeal catheter during the procedure to increase the fraction of inspired oxygen (FiO2) and maintain a SpO2 of at least 85%. The endotracheal tube (ETT) and bronchoscope were lubricate with 2% lidocaine gel. The ETT was then slid over the bronchoscope and the cuff completely deflated. With the bronchoscope in the trachea, the tube was advanced to the distal trachea and then pulled to a distance of 3 cm from the carina to prevent accidental selective intubation of the main bronchi. Finally, the cuff was inflated. Using this method, all existing patients were intubated and their operations were completed while they remained under anaesthesia.

Statistical Analysis

Statistical analyses were performed using the SPSS software package (SPSS Inc. Released 2015. SPSS for Windows, Version 23.0 Armonk, NY: IBM Corporation, USA). As descriptive statistics for numerical data, the mean (± standard deviation) in variables that provide the assumption of normal distribution, and the median value (minimum-maximum) in variables that do not; numbers and percentages were used to summarize the qualitative data. Student's t-test and ANOVA test were used for relationships between quantitative data. Pearson's chi-square test, Fisher's exact chi-square test and conditional exact chi-square test were used to investigate the relationships between qualitative data. The level of statistical significance was set at $\alpha = 0.05$.

Results

Of the patients included in the study, 38 (26.6%) were in the pediatric group and 105 patients (73.4%) were in the adult group. Of the patients, 74 (51.7%) were female and 69 (48.3%) were male. DI was performed in 50 patients due to syndromes with craniofacial abnormalities. The reasons for DI are listed in Table 1.

The predictable DI rate was significantly higher in the pediatric group than in the adults (p=0.005) (Table 2). When the relationship between predictable DI and age is examined, there is a 95% confidence interval relationship between intubation status and age. The probability of DI increases with age. The presence of concomitant syndromes with craniofacial abnormalities (Pierre Robin syndrome, Treacher Collins syndrome, Goldenhar syndrome, etc.) has been suggested as the most important reason for the higher known DI rate in children (Table 2).

Table 1. Age, sex distribution of the patients and reasons for difficult intubation

		Patient number (n: 143)	Percentage %	Total
Age	0-18 (Child)	38	26.6	100%
	+18 (Adult)	105	73.4	
Sex	Male	69	48.3	100%
	Female	74	51.7	
DI reason	Acquired	92	64.3	100%
	Syndromes	50	35	
		1	0.7	

DI: Difficult intubation

Table 2. Patient diagnoses and/or reasons for surgery

Surgery	Patient's # (n:143)	Percentage (%)
Ankylosis of the TMJ	18	12.6
Facial SCC, BCC, fibrous dysplasia	9	6.3
Maxillofacial trauma, motor vehicle accidents, facial paralysis, frontal bone anomaly	6	4.2
Mastectomy	12	8.4
Abdominoplasty	2	1.4
Bimaksillektomy, mandibular deformity, mandibular asymetria or hypoplasia, mandibular osteotomy	17	11.9
Cleft lip and palate	4	2.8
Nasal	4	2.8
Thyroidectomy	23	16.1
Other	28	19.6
Syndromes (Pierre Robin syndrome, Treacher Collins syndrome, Goldenhar syndrome)	11	7.7
Flip flap	6	4.2
Burn	1	0.7
Morbid obesity	1	0.7
Total	143	143

TMJ: Temporomandibular joint, SCC: Squamous cell cancer, BCC: Basal cell cancer

When the interclinical group was examined, it was found that the use of FBI was higher in plastic surgery operations compared to other clinics in 89 patients (62.2%) (Table 3). Patients' mouth opening (less than 3.8 cm was defined as restricted), type of intubation (nasal or oral route) and Mallampati scores (score 1- 4) were evaluated (Table 4).

As a result of preoperative anaesthetic assessment, DI could be predicted in 74 patients (51.7%). Based on the history, physical examination and Mallampati score, DI was unexpectedly encountered in 69 (48.3%) of the patients. 84.1% of adults and 15.9% of children were assessed as unpredictable DI (Table 4-5). The percentage of patients encountering unpredictable DI was 28.9% in children and 55.2% in adults.

Differences were found in the relationship between surgery and nasal intubation ($p < 0.001$). Nasal intubation was used with a frequency of 75% in orthopedic surgeries, followed by plastic surgery with 54.3% (Table 4).

Of the patients with predictable DI, 36.5% were children and 63.5% were adults. While 71.1% of children have predictable DI, this rate is 44.8% for adults. Unpredictable DI is present in 28.9% of children but in 55.2% of adults (Table 6).

Table 3. FBI use among clinics performing surgery

Clinics	Number of patients (n:143)	Percentage (%)
General surgery	38	26.6
Ear, Nose, Throat	4	2.8
Orthopedy	4	2.8
Plastic surgery	89	62.2
Urology	2	1.4
Total	143	100

Table 4. Mouth opening, type of intubation and Mallampati scores of the patients

		Patient's # (n: 143)	%	Total
Patient's mouth opening	Limited	58	40.6	100%
	Normal	84	58.7	
	Missing data*	1	0.7	
Intubation type	Nasal	62	43.4	100%
	Oral	81	56.6	
Mallampati	1	41	28.7	100%
	2	29	20.3	
	3	23	16.1	
	4	44	30.8	
		2	1.3	

*Patient data not available

Table 5. Predictable DI

	Number of patients(n:143)	Percentage (%)
Yes	74	51.7
No	69	48.3
Total	143	100

DI: Difficult intubation

Table 6. Distribution of predictable DI cases by age

Predictable DI	0-18 (Child)	27	36.5%	Distribution by Age Group	71.1%
	+18 age (Adult)	47	63.5%		44.8%
Unpredictable DI	0-18 age (Child)	11	15.9%		28.9%
		58	84.1%		55.2%

DI: Difficult intubation

Discussion

In our study, we investigated the incidence of predicted DA in patients intubated for DA with FBI. The relationship between predictable DI cases and age was retrospectively investigated. We found that the rate of DI was significantly higher in children than in adults. The presence of concomitant syndromes with craniofacial abnormalities (Pierre Robin syndrome, Treacher Collins syndrome, Goldenhar syndrome, etc.) was considered an important reason for the higher known DI rate in children.

Several factors suggest FBI, including a history of DI, short thyromental distance, macroglossia, obesity, sleep apnea, inability to extend the neck or cervical instability, fragile or protruding teeth and patients in Mallampati classes III-IV [10]. In our study, age, sex, mouth opening, Mallampati score and reason for intubation difficulty were considered as parameters for FBI indication. We found that the rate of DI was higher in children than in adults, and the main reason was syndromes with craniofacial abnormalities in children.

In patients with pathologies of the head and neck, congenital craniofacial defects such as micrognathia, cancers of the head and neck that may alter airway anatomy, surgical scarring and radiation fibrosis present challenges for airway management. Research has shown that pathology of the neck and head significantly increases the risk of death during general anesthesia due to DA [11].

In such cases, FBI is ideal for endotracheal intubation as it reduces the risk of neurological injury [12]. The FBI alone can be technically difficult and patient cooperation is also critical, which can be difficult in pediatric patients. Supraglottic airway devices may be a viable alternative to FBI in the management of DA in children [13].

Generally, airway management is performed in the OR and unexpectedly DI is a life-threatening event whose incidence varies widely with an estimated pooled incidence of 6.8% [14].

Based on a retrospective review of 40 years of records in a single, specialised hospital in Australia, Hosking et al. [15] identified 59 children with Treacher Collins syndrome per 50,000 births. This study involved 35 children who received 240 anesthetics from pediatric anesthetists. 53% of the children were classified by Cormack and Lehane as III or IV based on direct laryngoscopy. Other intubation techniques were used instead of direct laryngoscopy in 41% of patients. Although Hosking et al. [15] used retrospective databases over 40 years, they were also important for two other reasons: first, the authors assessed the difficulty of laryngoscopy over time and found that the difficulty of Treacher Collins syndrome increased with age. Unlike patients with Pierre Robin sequence, intubation usually becomes easier in adolescence when the mandible regains size. Secondly, the authors show with admirable honesty that a large number of anesthetic records do not have adequate and sufficient documentation. This is probably a common problem in most anesthesia records [15].

In a retrospective analysis, Marston et al. [16] reviewed 16 neonates up to 3 months of age using the Pierre Robin sequence. We found that the predictive DI rate was significantly higher in the pediatric group than in adults (p=0.005) (Table 2). The presence of concomitant congenital anomalies (Pierre Robin syndrome, Treacher Collins syndrome, Goldenhar syndrome, etc.) was considered an important reason for the higher known DI rate in children. DI was detected in 50 patients due to a congenital anomaly. The reasons for DI are listed in Table 1. The likelihood of DI increases with age. The most important reason for the higher known DI rate in children was thought to be the presence of concomitant syndromes with craniofacial abnormalities (Pierre Robin syndrome, Treacher Collins syndrome, Goldenhar syndrome, etc.) (Table 2). Patients' mouth opening (below 3.8 cm was defined as restricted), type of intubation (nasal or oral) and Mallampati scores (score 1- 4) were evaluated (Table 4).

In maxillofacial surgery, direct laryngoscopy with a Miller blade was required in 37% of all intubations; flexible FBIs were used in 63% of cases. According to Stricker et al. [17], the Pierre Robin sequence uses SAD as an instrument for ventilation and oxygenation [8].

The study by Lim CH et al. [18] reported 217 cases of DI with a mean DI incidence of 0.49%. DI rates were highest in departments of oral and maxillofacial surgery (1.35%), ophthalmic surgery (0.96%), urology (0.80%) and head and neck surgery (0.62%). When we examined the interclinical group, we found that the use of FBI was higher in plastic surgery than in other hospitals in 89 patients (62.2%) (Table 3). In our study, differences were found in the relationship between surgery and nasal intubation ($p < 0.001$). Nasal intubation was used with a frequency of 75% in orthopedic surgery, followed by plastic surgery with 54.3% (Table 4).

Compared with videolaryngoscopy, FBI via the supraglottic airway had similar success rates (67 of 114 versus 404 of 786; odds ratio 1.35; 95% CI, 0.91 to 2.00; P = 0.16) according to Burjek NE et al. [19]. The FBI via supraglottic airway was more

successful on the first attempt in subjects younger than one year (19 of 35, 54% vs. 79 of 220, 36%; odds ratio, 2.12; 95% CI, 1.04 to 4.31; P = 0.042). In our study, DI could be predicted as a result of preoperative anesthetic assessment in 74 patients (51.7%). Based on the history, physical examination and Mallampati scoring, 69 (48.3%) patients were found to have an unexpected DI. Unpredictable DI occurs in 15.9% of children and 84.1% of adults (Table 4-5). The percentage of patients with unpredictable DI was 28.9% in children and 55.2% in adults. Of the patients with predictable DI, 36.5% were children and 63.5% were adults. While 71.1% of children have predictable DI, this rate is 44.8% for adults. Unpredictable DI is present in 28.9% of children but in 55.2% of adults (Table 6).

Burjek NE et al. [19] that FBI via supraglottic airway and videolaryngoscopy have similar first attempt success rates. In infants with difficult airways, FBI via the supraglottic airway is more likely to be successful on the first attempt than videolaryngoscopy. Hypoxaemia can be reduced by continuous ventilation of the supraglottic airway during FBI operations. We have also found that the use of FBI is more appropriate in unexpectedly DI situations and our success rate is higher [19].

Adverse events related to anesthesia are common in children with severe hypoxaemia. Children have been associated with serious complications such as cardiac arrest due to multiple tracheal intubation attempts, age, weight and abnormal airway anatomy. Tracheal intubation techniques with high first-pass success rates may reduce these complications, but most studies of tracheal intubation procedures in children with DA are based on simulations on a practise manikin or single center studies. To improve outcomes for children with DA, techniques with high first-pass success rates need to be identified in a larger population [19]. We did not capture the complications that occurred during FBI, which is one of the major limitations of our study.

Our study also has some other limitations. First, due to the retrospective nature of the study, the incidence of DI may be underestimated. Secondly, apart from Mallampati and mouth opening, we have no record of thyromental height, ASA physical status and distress, intubation time and complication. In addition, the fact that the assessor is an assistant can be considered a further limitation.

Conclusion

According to the results of our study, it is difficult to test all the predictors of DI in a pre-anaesthetic assessment and some of the predictors may be inadequate. Therefore, clinical preparation and practical management are crucial, as is the preparation of an induction plan. Anesthetists can improve the management of airway pathology by using radiology, multi-planar reformations and nasendoscopy, the latter being available to them. The use of multivariate risk factor systems, such as simplified risk factors, can also be helpful in assessing patients so that appropriate airway management techniques can be used when DI occurs. Communication and documentation of any difficulties encountered are crucial for further management.

Ethics approval

This retrospective study has been approved by the local ethics committee and conducted in accordance with the Declaration of Helsinki (2000).

Declaration of conflict of interest

All authors declare no conflicts of-interest related to this article.

Author contributions

Ersoy Z, Canbay O designed the study; Ersoy Z performed the data collection and provided the statistical analysis; Ersoy Z wrote the manuscript under the supervision and with the input of Canbay O; Ersoy Z submitted the manuscript and all supporting documents.

Institutional review board statement

This study was approved by the Hacettepe University Institutional Review Board and Ethics Committee with a waiver of informed consent.

Informed consent statement

Patients were not required to give informed consent to the study as the analysis used anonymous clinical data that were obtained after each patient agreed to treatment by written consent.

Data sharing statement

Data sharing is available.

References

1. Lundstrom LH, Moller AM, Rosenstock C, Astrup G, Gatke MR, Wetterslev J, et al. A documented previous difficult tracheal intubation as a prognostic test for a subsequent difficult tracheal intubation in adults. Anaesthesia 2009;64:1081-1088.
2. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al. 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 2013;118:251-270.

3. Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Dutton RP, et al. 2022 American society of anesthesiologists practice guidelines for management of the difficult airway. Anesthesiology 2022;136:31-81.
4. CalderI.MurphyP.Afibre-opticendoscopeusedfornasalintubation. Anaesthesia 1967; 22:489-91. Anesthesia 2010;65(11):1133-6. http://doi.org(10.1111/j.1365-2044.2010.06535.x
5. Heidegger T, Gerig HJ. Algorithms for management of the difficult airway. Curr Opin Anaesthesiol 2004; 17:483-4484.
6. Wanderer JP, Ehrenfeld JM, Sandberg WS, Epstein RH. The changing scope of difficult airway management. Can J Anaesth 2013; 60:1022-1024.
7. Wong J, Lee JSE, Wong TGL, Igbal R, Wong P. Fiberoptic intubation in airway management: a review article. Singapore Med J 2019;60(3):110-118. http://doi.org/10.11622/smed,2018081
8. Russo SG, Becke K. Expected difficult airway in children. Anesthesiology 2015;28(3):321-326.
9. Rosenblatt WH, Yanez ND. Adcision tree approach to airway management pathways in the 2022 difficult airway algorithm of the American Society of Anesthesiologits. 2022, Anesthesia-Analgesia 2022;134(5):910-915.
10. Rodrigues AJ, Scordamaglio PR, Palomino AM, Oliveria EQ, Jacomelli M, Figueiredo VR. Difficult airway intubation with flexible bronchoscope. Rev Bras Anesthesiol. 2013;63(4):358-361.
11. Campling EA, Devlin HB, Hoile RW, Lunn JN. The report of the National Confidential Enquiry into Perioperative Deaths 1992/1993. London: National Confidential Enquiry into Perioperative Deaths; 1995. www.ncepod.org.uk/pdf/1992_3/Full Report 1992-1993.pdf. Accessed May 2, 2014.
12. Bhat R, Mane RS, Patil MC, Suresh SN. Fiberoptic intubation through laryngeal mask airway for management of difficult airway in a child with Klippel-Feil syndrome. Saudi J Aneaesth. 2014;8(3):412-414. http://doi.org/10.4103/1658-354X.136637
13. Lee JJ, Lim BG, Lee MK, Kong MH, Kim JK, Lee JY. Fiberoptic intubation through a laryngeal mask airway as a management of difficult airwary due to the fusion of the entire cervical spine-A report of two cases. Korean J Anesthesiol 2012;62:272-276.
14. Lundstrøm LH, Vester-Andersen M, Møller AM, Charuluxananan S, L'hermite J, Wetterslev J. Poor prognostic value of the modified Mallampati score: a metaanalysis involving 177088 patients. British Journal of Anaesth 2011;107(5): 659-667. http://doi.org/10.1093/bja/aer292
15. Hosking J, Zoanetti D, Carlyle A, Anderson P, Costi D. Anesthesia for Treacher Collins syndrome: a review of airway management in 240 pediatric cases. Paediatr Anaesth 2012; 22(8):752-758. http://doi.org/10.1111/j.1460-9592.2012.03829.x
16. Marston AP, Lander TA, Tibesar RJ, Sidman JD. Airway management for intubation in newborns with Pierre Robin sequence. Laryngoscope 2012;122(6):1401–1404. http://doi.org/ 10.1002/lary.23260
17. Stricker PA, Budac S, Fiadjoe JE, Rehman MA. Awake laryngeal mask insertion followed by induction of anesthesia in infants with the Pierre Robin sequence. Acta Anaesthesiol Scand 2008; 52(9):1307–1308. http://doi.org/10.1111/j.1399-6576.2008.01751.x
18. Lim CH, Kim YJ, Kim JH, Jeong JS. Retrospective analysis of difficult entubation. Ewha Med J. 2017;40(3):115-121. http://doi.org/10.12771/emj.2017.40.3.115
19. Burjek NE, Nishisaki A, Fiadjoe JE, Adams HD, Peeples KN, Raman VT. Videolaryngoscopy versus Fiber-optic Intubation through a Supraglottic Airway in Children with a Difficult Airway: An Analysis from the Multicenter Pediatric Difficult Intubation Registry. Anesthesiology 2017; 127(3):432-440. http://doi:10.1097/ALN.0000000000001758