Original Article

Anticipated and Unanticipated Difficult Intubation in the Perioperative and Anesthetic Adverse Events in Thailand (PAAd Thai) Study

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Background: Difficult intubation is a common problem. The Perioperative and Anesthetic Adverse Events in Thailand (PAAd Thai) Study was performed in 22 hospitals across Thailand in 2015 to investigate incidence of anesthesia related adverse events including the difficult intubation events.

Objective: To evaluate the difficult intubation events in terms of prediction, management, complications, contributing factors, and corrective strategies, and compare the management of the unanticipated (UDI) and anticipated difficult intubation (ADI).

Materials and Methods: The multicenter-observational study was prospectively performed. The research on difficult intubation was obtained using data from the first 2,000 events of the study. There were 115 difficult intubation events. The described details of each report on management of difficult intubation and outcomes were reviewed by two anesthesiologists. The opinions on causative factors, contributing preventive factors, and strategies for correction were agreed by three reviewers.

Results: Sixty-nine and forty-six cases were indicated as UDI and ADI, respectively. Almost all of the patients in UDI group were successfully intubated under general anesthesia (95.7%) by switching of intubators (67.7%), using stylet (20%), and/or using different laryngoscopic blades (50.7%). The most successful blade in UDI was the direct laryngoscopic blade. The main rescue blade after failed direct laryngoscopy was the videolaryngoscopic blade. Most of the ADI were successfully intubated by using the videolaryngoscopic blade. Immediate complications were not significantly different. Cardiac arrest was found only in the immediate postoperative period. The contributing factors included inadequate experience, inappropriate decision, and inadequate airway evaluation.

Conclusion: Most of the UDI and ADI were successfully intubated by using conventional technique and videolaryngoscope, respectively. The immediate adverse effects were not significantly different. Proper preparation, additional training, and presence of experienced anesthesia personnel would decrease the incidences and improve anesthetic outcomes.

Keywords: Anticipated difficult intubation, Unanticipated difficult intubation, Complication, Adverse events, Anesthesia

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Difficult intubation is a common clinical problem encountered by anesthesiologists. In the general surgical population, a definite grade III laryngoscopic view requiring multiple intubation attempts occurs in 1% to 4% of the patients[1]. In Thailand, the Royal College of Anesthesiologists of Thailand (RCAT) previously performed a multi-centered study of anesthesia related events between 2003 and 2004 (THAI Study)[2]. It was reported that difficult intubation as well as failed intubation were 0.23% and 0.03%, respectively. Most of the difficult intubated patients were successfully intubated

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using a conventional technique. Recently, in 2015, the Perioperative and Anesthetic Adverse Events in Thailand (PAAd Thai) Study, a multi-center observational study, has prospectively reviewed the incidence of this event according to a novel approach for airway management such as more frequent use of laryngeal mask airway (LMA), and more access of videolaryngoscope[3]. In addition, the American Society of Anesthesiologist and the Difficult Airway Society also revised difficult airway management algorithms for unanticipated (UDI) and anticipated difficult airways[4,5].

The objective of the present study was to evaluate the difficult intubation events in Thailand in terms of prediction, management, complications, contributing factors, and corrective strategies. Moreover, the authors also compared the management of UDI and anticipated difficult intubation (ADI).

Materials and Methods

The multicenter-observational study was prospectively performed in 22 hospitals across Thailand. The PAAd Thai study was approved by each Institutional Ethical Committee, informed consent was waived due to observational study. Method of study and hospital characteristics were previously described[6]. The analysis on difficult intubation was obtained using data from the first 2,000 events of the study, which was collected between January and November 2015.

Difficult intubation was defined as an intubation, which required at least three attempts by trained anesthesia personnel, or more than 10 minutes in performing a successful endotracheal insertion. If the intubation was unsuccessful, the data was excluded and then analyzed as a failed intubation. Demographic data such as age, sex, body mass index, and clinical predictor of difficult intubation (Mallampati [MP] class and thyromental distance [TMD]) were recorded. The detail of difficult-intubation incidences included an intubation process and number of intubation attempts were recorded as a short essay in the record form. These data were then extracted by two anesthesiologists. The anticipated and UDI difficult intubations were determined by using data from the original records. Data regarding contributing factors and strategies for prevention and improvement were reviewed by the two anesthesiologists who extracted data and another one. Conflicting opinions were discussed, and consensus concluded. Data were analyzed by using descriptive statistics and program R. Categorical variables were compared using Fisher's exact test for non-normally distributed data or Pearson's Chi-square test for normally distributed data. The missing data or non-stated data were not used in calculation of p-value. The difference with a p-value smaller than 0.05 was defined as significant.

Results

Overall characteristics of difficult-intubated patients

From 2,000 adverse events in patients that underwent anesthesia, there were 115 difficult-intubated events. Almost all incidents occurred during induction. Two cases occurred within the immediate postoperative period due to post-thyroidectomy bleeding and ruptured of endotracheal tube cuff. Fifty cases (43.5%) were presented in university-based hospitals. Demographic data of the patients are shown in Table 1. Most of the patients were female and not obese. Twenty seven percent of the patients had MP grade III and IV, and 21.7% of the patients had short TMD. Narrow interincisor gap (ICG), neck mass or infection, and limited neck movement were reported in 10, 10, and 8 patients, respectively. Six patients had previous history of difficult intubation. Laryngoscopic views were mainly grade 3 and 4, (81.7%).

Overall intubation details are shown in Table 2. Mean intubation attempts and intubation time were 3.92 (n = 110) and 37 minutes (n = 23), respectively. Nine patients were converted from general anesthesia to awake intubation. Two patients failed from awake-intubation initially, so were then converted to intubation after induction of anesthesia. Successful intubation was achieved by changing of the person performing the intubation (60.9%), and/or use of additional devices (classic stylet, Frova intubating introducer or gum elastic bougie) (15.7%).

Predictors of difficult intubation

There were 46 anticipated, difficult-intubated patients. MP grade III and IV, TMD of less than 5 cm, ICG of less than 3 cm and history of difficult intubation were used significantly for prediction of difficult intubation (Table 3). Six patients presented with history of difficult intubation. Five patients were predicted and were prepared for difficult intubation. The anesthetic team did not recognize the problem of one patient due to emergency condition. The four patients with deep neck infection were diagnosed as being ADI.

There were 69 UDI difficult-intubated patients. There was no patient with MP grade IV in this group. After exclusion of pediatric patients, nine cases were not evaluated MP preoperatively. In ten cases

Table 1. Demographic data of the 115 difficult-intubated patients

	Total 115 n (%)
Sex	
Female	69 (60.0)
Male	45 (39.1)
Not stated	1 (0.9)
Age (years)	
0 to 11.9	16 (13.9)
12 to 64.9	81 (70.4)
>65	18 (15.7)
ASA classification	
I	21 (18.2)
II	44 (38.3)
III	44 (38.3)
IV	3 (2.6)
V	0 (0.0)
Not stated	3 (2.6)
Body mass index	
<18	13 (11.3)
18 to 24.9	39 (33.9)
25 to 34.9	33 (28.7)
≥35	4 (3.5)
Not stated	26 (22.6)
Operation	
General surgery	42 (36.5)
Eye, ear-nose-throat	31 (27.0)
Obstetrics-Gynecology	10 (8.7)
Orthopedic surgery	20 (17.4)
Other surgery	12 (10.4)
Mallampati grading	
1	14 (12.2)
2	40 (34.8)
3	18 (15.7)
4	13 (11.3)
Cannot evaluated	16 (13.9)
Not stated	14 (12.1)
Thyromental distance	
≥5 cm	60 (52.2)
<5 cm	25 (21.7)
Not evaluated	16 (13.9)
Not stated	14 (12.2)
Laryngoscopic view	
1	6 (5.2)
2	8 (7.0)
3	59 (51.3)
4	35 (30.4)
Not stated	7 (6.1)

ASA=American Society of Anesthesiologist

Table 2. Overall intubation detail (n = 115)

	n (%)
First intubation	
Technique of intubation	
• After induction	105 (91.3)
• Awake intubation	8 (7.0)
• Not stated	2 (1.7)
Equipment	
• Conventional laryngoscope	89 (77.4)
• McCoy blade	7 (6.1)
• Videolaryngoscope	9 (7.8)
• Fiberoptic	4 (3.5)
• Tube exchanger	1 (0.9)
• Not stated	5 (4.3)
Successful intubation	
Technique of intubation	
• Under GA	98 (85.2)
• Awake intubation	15 (13.1)
• Not stated	2 (1.7)
Equipment	
• Conventional laryngoscope	38 (33.0)
• McCoy blade	13 (11.3)
• Videolaryngoscope	44 (38.3)
• Fiberoptic	9 (7.8)
• Bronchoscope	3 (2.6)
• Blinded nasal intubation	1 (0.9)
• Not stated	7 (6.1)
Performers	
• Anesthesiologist	82 (71.2)
• Other trained personnel	15 (13.1)
• Surgeon	3 (2.6)
• Not stated	15 (13.1)

GA=general anesthesia

presented with one predictor, MP grade III, poor TMD, limit of ICG, and limit of neck movement were seen in two, four, one, and three cases respectively. One patient presented with both MP grade III and limitation of neck movement.

Anesthetic management in unanticipated (UDI) and anticipated (ADI) difficult intubated patients

Intubation attempts (3.8±1.65 versus 4.1±1.7) were not significantly different between UDI and ADI groups. Time to success compared between UDI and ADI groups was, however, significantly different [22.3±13.6 minute (n = 14) versus 60.6±57.4 minute (n = 9)]. Propofol was used more than any other induction agent in ADI group (Table 4). Succinylcholine, narcotics and midazolam were similarly used between

Table 3. Compared demographic data in anticipated and unanticipated difficult-intubated patients

	Unanticipated (n = 69) n (%)	Anticipated (n = 46) n (%)	p-value
Operation			0.013
General surgery	31 (44.9)	11 (23.9)	
Orthopedic	13 (18.8)	7 (15.2)	
Eye, ear-nose-throat	12 (17.4)	19 (41.3)	
Obstetrics-Gynecology	8 (11.6)	2 (4.4)	
Other surgery	5 (7.3)	7 (15.2)	
Sex			0.944
Female	32 (46.4)	22 (47.8)	
Male	37 (53.6)	23 (50.0)	
Not stated	0 (0.0)	1 (2.2)	
ASA classification			0.323
I	15 (21.7)	6 (13.0)	
II	28 (40.6)	16 (34.8)	
III	23 (33.3)	21 (45.7)	
IV	1 (1.5)	2 (4.3)	
V	0 (0.0)	0 (0.0)	
Not stated	2 (2.9)	1 (2.2)	
Age (years), Mean±SD	45.0±22.6	45.9±20.5	0.842
0 to 1	6 (8.7)	2 (4.4)	
>1 to 11.9	5 (7.3)	3 (6.5)	
>12 to 64.9	47 (68.1)	34 (73.9)	
≥65	11 (15.9)	7 (15.2)	
Mallampati grading			<0.001
1	12 (17.4)	2 (4.4)	
2	35 (50.7)	5 (10.9)	
3	3 (4.3)	15 (32.6)	
4	0 (0.0)	13 (28.2)	
Cannot evaluated	9 (13.1)	7 (15.2)	
Not stated	10 (14.5)	4 (8.7)	
Thyromental distance			<0.001
≥5 cm	48 (69.6)	12 (26.1)	
<5 cm	4 (5.8)	21 (45.6)	
Not evaluated	11 (15.9)	5 (10.9)	
Not stated	6 (8.7)	8 (17.4)	
Interincisor gap			0.001
≥3 FB	15 (21.7)	5 (10.9)	
<3 FB	1 (1.5)	9 (19.5)	
Not stated	53 (76.8)	32 (69.6)	
History of difficult intubation			0.003
No	16 (23.2)	2 (4.3)	
Yes	1 (1.5)	5 (10.9)	
Not stated	52 (75.3)	39 (84.8)	

ASA=American Society of Anesthesiologist; FB=fingerbreadth; SD=standard deviation

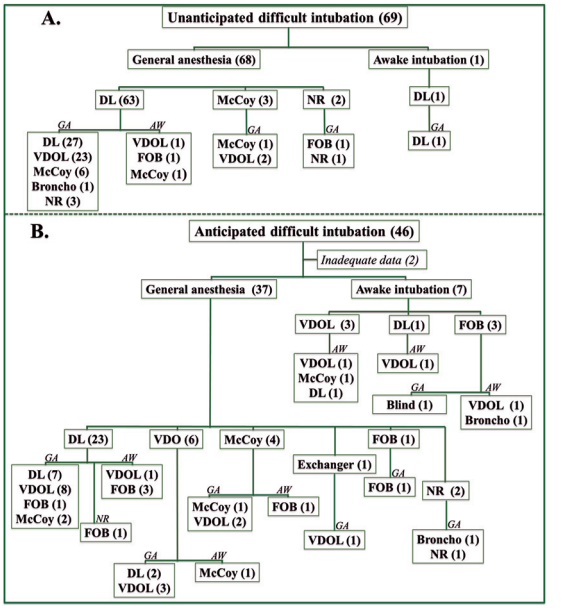

Figure 1. Methods of intubation. The figure shows only the initial and successful techniques. A) Unanticipated difficult intubation. B) Anticipated difficult intubation.

DL=direct laryngoscope (McIntosh and Miller blade), VDOL=videolaryngoscope, FOB=fiberoptic bronchoscope, Broncho=rigid bronchoscope, Blind=blind nasal intubation, Exchanger=tube exchanger, McCoy=Mccoy blade, NR=no record, GA=general anesthesia, AW=awake intubation

the two groups.

In the UDI group, a one-month-old infant was initially intubated on awake due to a high risk of aspiration (Figure 1). Sixty-eight patients were initially intubated under general anesthesia. Among these, three patients were converted to awake intubation. The other 65 patients were successfully intubated under general anesthesia by change of intubators (n = 44, 67.7%), using stylet including Frova intubating introducer and gum elastic bougie (n = 13, 20%), and/or using a different laryngoscopic blade (n = 33, 50.7%). In UDI group, the most successful blade was the direct laryngoscopic blade (42%). The main rescue blade after failed direct laryngoscopy was a videolaryngoscopic blade (37.7%).

In ADI group, awake intubation was performed on seven patients (15.2%) (Figure 1). The initial intubators were mainly anesthesiologists (p<0.001) (Table 4). More than half of the ADI group were intubated by using a direct laryngoscopic blade on the first attempt (56.5% n = 26). The main rescue blade was a videolaryngoscopic blade (38.4%). Among the nine intubations performed with the use of a videolaryngoscopic blade on the first attempt, four patients were successfully intubated with the same blade, after initial intubation failed.

Table 4. Anesthetic management in patients with anticipated and unanticipated difficult intubation

	Unanticipated (n = 69) n (%)	Anticipated (n = 46) n (%)	p-value
Induction agents			0.007
Propofol	38 (55.1)	33 (71.7)	
Thiopenthal	28 (40.5)	6 (13.1)	
Etomidate	1 (1.5)	1 (2.2)	
Not stated	2 (2.9)	6 (13.0)	
Laryngoscopic view			0.217
1	4 (5.8)	2 (4.3)	
2	4 (5.8)	4 (8.7)	
3	40 (58.0)	19 (41.3)	
4	19 (27.5)	16 (34.8)	
Not stated	2 (2.9)	5 (10.9)	
First intubation			
Performer			<0.001
• Anesthesiologist	9 (13.0)	18 (39.2)	
• Others	51 (74.0)	17 (36.9)	
• Not stated	9 (13.0)	11 (23.9)	
Experience (years), Mean±SD	4.2±6.0	6.7±8.6	0.148
Airway devices			0.001
• Oroendotracheal tube	69 (100)	39 (84.8)	
• Nasoendotracheal tube	0 (0.0)	5 (10.9)	
• Laryngeal mask airway	0 (0.0)	1 (2.2)	
• Microlaryngeal tube	0 (0.0)	1 (2.2)	
Successful intubation			
Airway devices			0.020
• Oroendotracheal tube	67 (97.0)	39 (84.8)	
• Nasoendotracheal tube	1 (1.5)	6 (13.0)	
• Microlaryngeal tube	1 (1.5)	1 (2.2)	
Performers			0.003
• Anesthesiologist	50 (72.5)	32 (69.6)	
• Anesthesia Fellow	0 (0.0)	2 (4.3)	
• Others	12 (17.4)	4 (8.7)	
• Not stated	7 (10.1)	8 (17.4)	

SD=standard deviation

Table 5. Complications regarding to age range

	<12 years (n = 16) n (%)	12 to 64.9 years (n = 81) n (%)	≥65 years (n = 18) n (%)	p-value
Laryngospasm				0.010
Yes	3 (18.75)	1 (1.24)	1 (5.56)	
No	11 (68.75)	73 (90.12)	17 (94.44)	
Not stated	2 (12.50)	7 (8.64)	0 (0.00)	
Hypoxia				<0.001
Yes	9 (56.25)	10 (12.35)	0 (0.00)	
No	6 (37.50)	61 (75.30)	16 (88.89)	
Not stated	1 (6.25)	10 (12.35)	2 (11.11)	
Bradycardia				<0.001
Yes	6 (37.50)	2 (2.47)	0 (0.00)	
No	7 (43.75)	75 (92.59)	18 (100)	
Not stated	3 (18.75)	4 (4.94)	0 (0.00)	
Airway injury				0.700
Yes	0 (0.00)	9 (11.12)	4 (22.22)	
No	13 (81.25)	61 (75.30)	13 (72.22)	
Not stated	3 (18.75)	11 (13.58)	1 (5.56)	
Remain intubation				0.041
Yes	4 (25.00)	11 (13.58)	3 (16.67)	
No	5 (31.25)	52 (64.19)	9 (50.00)	
Tracheostomy	2 (12.50)	1 (1.24)	0 (0.00)	
Not stated	5 (31.25)	17 (20.99)	6 (33.33)	
Bronchospasm				0.557
Yes	1 (6.25)	3 (3.70)	0 (0.00)	
No	13 (81.25)	65 (80.25)	17 (94.44)	
Not stated	2 (12.50)	13 (16.05)	1 (5.56)	
Esophageal intubation				0.891
Yes	3 (18.75)	21 (25.93)	5 (27.78)	
No	13 (81.25)	60 (74.07)	13 (72.22)	
Laryngoscopic view				0.001
1	4 (25.00)	2 (2.47)	0 (0.00)	
2	2 (12.50)	4 (4.94)	2 (11.11)	
3	3 (18.75)	45 (55.56)	11 (61.11)	
4	3 (18.75)	27 (33.33)	5 (27.78)	
Not stated	4 (25.00)	3 (3.70)	0 (0.00)	

Complications

The incidences of laryngospasm (5.8% versus 2.2%), airway injury (8.7% versus 15.2%), hypoxia (18.8% versus 13.0%), bradycardia (7.2% versus 6.5%), esophageal intubation (26.1% versus 23.9%), and cardiac arrest (0% versus 2.2%) were not significantly different between the UDI and ADI groups. However, remained intubation tended to increase in the ADI group (26.1%) (p=0.007). Two patients in the ADI group got cardiac arrested during difficult intubation. Both cases were intubated at the immediate postoperative period. One was reintubated due to post-thyroidectomy bleeding, while the other was reintubated due to endotracheal tube cuff leakage. Regarding the aging factor, children seemed to have a higher rate of laryngospasm, hypoxia, and bradycardia than adults (Table 5). However, the laryngoscopic views were better in children.

Possible cause of difficult intubation

From the opinion of the record performers as well as the experts, the main cause of difficult intubation was rated to patient factors. Twenty-eight events were related to a combined anesthetic-patient factor (24.4%). Surgical factors were presented for one patient. In the UDI group, the possible major cause

Table 6. Possible causes of difficult intubation

	Unanticipated (n = 69) n (%)	Anticipated (n = 46) n (%)	p-value
Patient cause	68 (98.6)	46 (100)	1.000
Anesthetic cause	15 (21.7)	13 (28.3)	0.564
Surgical cause	0 (0.0)	1 (2.2)	0.400
Possible factors			0.003
Vocal cord anterior	43 (62.3)	15 (32.6)	
Limit of mouth opening	1 (1.4)	4 (8.7)	
Limit of neck movement	4 (5.8)	5 (10.9)	
Abnormal larynx/trachea	4 (5.8)	1 (2.2)	
Obesity	3 (4.3)	3 (6.5)	
Tonsil enlargement	2 (2.9)	1 (2.2)	
Infancy	4 (5.8)	0 (0.0)	
Airway swelling	1 (1.4)	3 (6.5)	

of difficult airways was vocal cord anterior (Table 6).

Regarding the contributing factors, lack of experience was considered in both groups. In the ADI group, inappropriate decisions were significantly higher than that of the UDI group (Table 7). Inadequate airway evaluation was presented in 34.8% and 30.4% in the UDI and ADI group, respectively. To decrease the incidence of difficult intubation, experienced performers and expert assistants are key factors. In addition, vigilance and functional and proper equipment were also required. For corrective strategies, most of the intubators should have additional training, follow practice guidelines, and perform under adequate supervision.

Table 7. Factors minimizing incidents

	Unanticipated (n = 69) n (%)	Anticipated (n = 46) n (%)	p-value
1. Contributing factors			
Not follow the checklist	6 (8.7)	2 (4.3)	0.473
Inappropriate decision	11 (15.9)	20 (43.5)	0.002
Lack of knowledge	2 (2.9)	4 (8.7)	0.216
Lack of experience	45 (65.2)	26 (56.5)	0.457
Emergency condition	13 (18.8)	6 (13.0)	0.573
Inadequate airway evaluation	24 (34.8)	14 (30.4)	0.777
Not enough equipment	6 (8.7)	10 (21.7)	0.088
2. Factors minimizing incidents			
Follow surgical the checklist	7 (10.1)	2 (4.3)	0.312
Previous experience	49 (71.0)	40 (86.9)	0.076
Expert assistants	44 (63.8)	28 (60.9)	0.906
Vigilance	33 (47.8)	30 (65.2)	0.100
Consultation system	4 (5.8)	8 (17.4)	0.063
Good communication	5 (7.2)	2 (4.3)	0.700
Improve training system	3 (4.3)	2 (4.3)	1.000
Adequate equipment	10 (14.5)	13 (28.3)	0.116
Follow the practice guideline	2 (2.9)	3 (6.5)	0.388
3. Suggestive corrective strategies			
Follow the surgical checklist	8 (11.6)	4 (8.7)	0.760
Guideline practice	16 (23.2)	15 (32.6)	0.368
Additional training	54 (78.3)	30 (65.2)	0.184
More manpower	5 (7.2)	5 (10.9)	0.518
Improve supervision	29 (42.0)	18 (39.1)	0.908
Improve communication	2 (2.9)	5 (10.9)	0.114
Equipment maintenance	12 (17.4)	12 (26.1)	0.373
Quality assurance activity	2 (2.9)	4 (8.7)	0.216

Discussion

In the present study, 115 difficult intubations were reported within approximately 11 months. Sixteen patients were failed intubated[7] and were not included in the present study. Capnograph monitor was widely used, more than a decade ago (92.2% versus 66.2%). Mean intubation attempts were not significantly different between UDI and ADI. Two cases of cardiac arrest were presented in ADI at the immediate postoperative period. Hypoxia, bradycardia, and laryngospasm were all significantly higher in children.

Nørskov et al[8] showed that difficult intubations and UDI difficult intubations were approximately 1.86% and 1.73%, respectively. In Thai Anesthesia Incident Monitoring Study (AIMS)[2], the incidence of difficult intubation was 0.23%. Most of the difficult intubation events were likely to be unexpected. In this PAAd Thai study, the incidence cannot be calculated since the data were extracted from the first 2,000 events. However, the incidence per month seemed to decrease. Most difficult intubations were also UDI difficult intubations (60%). Most patients were not obese. This is the same as previously report by Thai AIMS.

In the present study, MP grade III/IV, short TMD, narrow ICG and history of difficult intubation were significantly used for the prediction of difficult intubations. However, the preoperative airway evaluation data were not completed in all cases. Ten patients, with isolated factor of MP grade III, short TMD, narrow ICG, or limit of neck movement were not considered as probable difficult intubation. The history of difficult intubation was missed in one patient due to emergency condition. It has been revealed that a previous history of difficult intubation was a strong predictor[9]. MP grade III also had a positive predictive value of difficult laryngoscopy; 3% to 5%[10]. Proper airway assessment and vigilance might improve

airway management.

In the Thai AIMS study[2], half of all difficult intubations (50.9%) were successfully intubated by conventional techniques. A McCoy blade was the second most successful device (9%). The PAAd Thai study revealed that 38.3%, 36.5%, and 11.3% were successfully intubated by videolaryngoscope, direct laryngoscope, and use of the McCoy blade, respectively. The Thai AIMS study revealed that most patients (87.2%) were intubated successfully within five attempts, which is similar to the present study (87.8%), even though videolaryngoscope was used more often.

It has been shown that after failed intubation with direct laryngoscope, video laryngoscopy was associated with a high rescue intubation success rate and used more than any other rescue technique[11]. In the present study, 51 patients were failed intubation by using direct laryngoscope in the first attempt, 33 and 18 patients in the UDI and ADI group, respectively. Thirty-five patients were successfully intubated by using a video laryngoscope, 72% and 61% in the UDI and ADI group, respectively. Videolaryngoscope is currently considered, in Thailand, as the successful rescue technique after failed intubation by direct laryngoscope approach.

No immediate complications were reported in half of the difficult-intubated patients. Immediate complications such as hypoxia, bradycardia, laryngospasm, and airway injury occurred in 16.5%, 6.9%, 4.3%, and 11.3%, respectively. No intraoperative awareness or pulmonary aspiration was reported. Two adult patients had cardiac arrest. The events occurred at immediate postoperative period. Both had a surgical operation on the neck and had immediate complications such as post-thyroidectomy bleeding and endotracheal balloon leakage. The emergency condition might increase the severity of difficulty for intubation. Compared to the Thai AIMS study, the incidence of immediate complications had decreased.

Contributing factors along with factors minimizing incidents were similar to those of Thai AIMS. Additional training coupled with better supervision are required to reduce the incidence of difficult intubation. However, careful preoperative airway assessment and vigilance may also decrease the incidence of difficult intubation.

Limitation of the present study was that the data were collected from a general incident report form. Therefore, some specific details related to difficult intubation, were not recorded causing some missing data. Variation among the hospitals in terms of anesthetic practice, experience, and airway devices may reflect as variation of practices.

In conclusion, the incidence of difficult intubation seemed to decrease compared to those reported ten years ago, since, videolaryngoscope has been widely used as a rescue technique, after a failed direct laryngoscope attempt, and in ADI. There was no significant difference of intubation attempts and immediate complications between anticipated and UDI difficult intubation.

What is already known on this topic?

Difficult intubation is a common problem. Currently, to decrease the incidence of difficult intubation, there are several updated guidelines regarding prediction and management of both anticipated and UDI difficult intubation.

What this study adds?

Besides using guidelines, careful preoperative assessment and vigilance may decrease the incidence of difficult intubation. In addition, lack of experience is still the major contributing factors similar to that reported ten years ago. Additional training and improved supervision may also reduce the difficult intubation events.

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Conflicts of interest

The authors declare no conflict of interest.

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