

**Table S1** Description of Airway Assessments

Variable	Detail
<b>Baseline characteristics</b>	
Age	Age of the patient
Gender	Gender of patient
ASA-PS	ASA-Physical Status: ASA-PS 1: in good health; ASA-PS 2: with mild comorbidities; ASA-PS 3: with severe comorbidities and limited activity ability; ASA-PS 4: with severe comorbidities and no activity ability
Height	Height of the patient
Weight	Weight of the patient
BMI	BMI of the patient
Education	Education level of the patient Education 1: Uneducated; Education 2: Junior high school or below; Education 3: High school education or above
History of alcohol	Whether the patient had a drinking habit.
History of smoking	Whether the patient had a smoking habit.
<b>Medical history</b>	
History of heart diseases	Whether the patient has a previous history of cardiovascular diseases.
History of lung diseases	Whether the patient has a previous history of respiratory diseases.
History of DM	Whether the patient has a previous history of diabetes.
History of HBP	Whether the patient has a previous history of hypertension.
Airway-related diseases	The definition of airway-related diseases is mainly based on 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway, including rheumatoid arthritis, ankylosing spondylitis, degenerative osteoarthritis, obstructive sleep apnea syndrome, Pierre-Robin syndrome, Klippel-Feil syndrome, Treacher-Collins syndrome, Down's syndrome, and airway masses.
History of rhinitis	Whether the patient has a previous history of rhinitis.
Nasal obstruction	Whether the patient is currently suffering from nasal obstruction.
History of snoring	Whether the patient has a previous history of snoring.
History of radiotherapy and chemotherapy	Whether the patient has a previous history of radiotherapy and chemotherapy.
History of surgery	Whether the patient has a previous history of surgery history.
History of mandibular surgery	Whether the patient has a previous history of mandible operation history.
History of tumors	Whether the patient has a previous history of maxillofacial tumors.
History of trauma	Whether the patient has a previous history of maxillofacial trauma.
buck teeth	Whether the patient currently has buck teeth.
epiglottis swelling	Whether the patient is currently suffering from epiglottis swelling.
<b>Bedside examinations</b>	
NC	neck circumference: circumference of the neck at the level of the thyroid cartilage.
CSM	cervical spine mobility CSM 1: > 90° CSM 2: 90° CSM 3: < 90°
MP	mandibular protrusion: the range of movement of the mandible; MP 1: The lower incisors extend beyond the upper incisors; MP 2: The lower incisors are flush with the upper incisors; MP 3: The lower incisors extend within the upper incisors;
ULBT	upper lip bite test: measured by asking patients to bite their upper lip with their lower incisors; UBLT 1: the lower incisors extend beyond the vermilion border of the upper lip; UBLT 2: the lower incisors bite the lip but cannot extend above the vermilion border; UBLT 3: the lower incisors cannot bite the upper lip;
MMT	modified Mallampati test: a grading system used to rate the visibility of the structures in the oropharynx, including the uvula, faucial pillars, and soft palate when the mouth is opened; MMT 1: the soft palate, the pharyngopalatine arch, the uvula, and the hard palate are visible; MMT 2: the soft palate, the uvula, and the hard palate are visible; MMT 3: the soft palate and the hard palate are visible; MMT 4: only hard palate is visible;
IIG	inter-incisor gap: the maximal distance between the upper and lower incisors.
LT	length of tongue: the maximum length of the tongue outside the mouth.
THD	thyroid and hyoid distance: the distance between the thyroid and the hyoid with the neck extended
HMD	hyomental distance: the distance between the hyoid bone and the mentum with the neck extended
TMD	thyromental distance: the distance between the upper-most border of the thyroid cartilage and the mentum with the neck extended.
SMD	sternomental distance: the distance between the upper border of the sternum and the tip of the jaw with the neck fully extended
ML	mandible length: the length of mandible.
JD	jaw depth: the distance of the edge of lower lip and chin
UIL	upper incisor length: the length of upper incisor.

BMI, body mass index; ASA-PS, American Society of Anesthesiologists Physical Status; MMT, modified Mallampati test; ULBT, upper lip bite test; MP, mandibular protrusion; NC, neck circumference; LT, length of tongue; JD, jaw depth; ML, mandible length; CSM, cervical spine mobility; IIG, inter-incisor gap; UIL, upper incisor length; TMD, thyromental distance; SMD, sternomental distance; THD, thyroid and hyoid distance; HMD, hyomental distance.

**Table S2** The characteristics of patients in the training set

Characteristics	Easy laryngoscopy (n=301)	Difficult laryngoscopy (n=18)	Overall P value
Age	27.81 (22.01, 39.13)	46.51 (35.40, 59.22)	<0.001
Gender			1.000
Female	180 (59.80%)	11 (61.11%)	
Male	121 (40.20%)	7 (38.89%)	
ASA-PS			0.146
1	272 (90.37%)	14 (77.78%)	
2	21 (6.98%)	4 (22.22%)	
3	7 (2.33%)	0 (0.00%)	
4	1 (0.33%)	0 (0.00%)	
Height	1.67 (1.61, 1.73)	1.65 (1.62, 1.72)	0.632
Weight	60.00 (51.00, 70.00)	62.50 (57.00, 69.25)	0.112
BMI	21.22 (19.03, 23.83)	22.59 (20.76, 26.20)	0.044
Education			0.023
1	50 (16.61%)	8 (44.44%)	
2	90 (29.90%)	3 (16.67%)	
3	161 (53.49%)	7 (38.89%)	
History of alcohol			0.540
No	248 (82.39%)	14 (77.78%)	
yes	53 (17.61%)	4 (22.22%)	
History of smoking			0.091
No	255 (84.72%)	12 (66.67%)	
Yes	46 (15.28%)	6 (33.33%)	
History of heart disease			0.478
No	291 (96.68%)	17 (94.44%)	
Yes	10 (3.32%)	1 (5.56%)	
History of lung disease			1.000
No	296 (98.34%)	18 (100.00%)	
Yes	5 (1.66%)	0 (0.00%)	
History of DM			0.375
No	294 (97.67%)	17 (94.44%)	
Yes	7 (2.33%)	1 (5.56%)	
History of HBP			0.072
No	286 (95.02%)	15 (83.33%)	
Yes	15 (4.98%)	3 (16.67%)	
Airway-related diseases			0.003
No	286 (95.02%)	13 (72.22%)	
Yes	15 (4.98%)*	5 (27.78%)**	
History of rhinitis			0.789
No	220 (73.09%)	14 (77.78%)	
Yes	81 (26.91%)	4 (22.22%)	
Nasal obstruction			1.000
0	280 (93.02%)	18 (100.00%)	
1	10 (3.32%)	0 (0.00%)	
2	7 (2.33%)	0 (0.00%)	
3	4 (1.33%)	0 (0.00%)	
History of Snoring			0.204
No	172 (57.14%)	7 (38.89%)	
Yes	129 (42.86%)	11 (61.11%)	
History of radiotherapy and chemotherapy			0.296
No	296 (98.34%)	17 (94.44%)	
Yes	5 (1.66%)	1 (5.56%)	
History of surgery			0.699
No	140 (46.51%)	7 (38.89%)	
Yes	161 (53.49%)	11 (61.11%)	
History of mandibular surgery			1.000
No	291 (96.68%)	18 (100.00%)	
Yes	10 (3.32%)	0 (0.00%)	
History of tumor			0.013
No	287 (95.35%)	14 (77.78%)	
yes	14 (4.65%)	4 (22.22%)	
History of trauma			0.411
No	293 (97.34%)	17 (94.44%)	
Yes	8 (2.66%)	1 (5.56%)	
Buck teeth			0.208
No	298 (99.00%)	17 (94.44%)	
Yes	3 (1.00%)	1 (5.56%)	
Epiglottis swelling			1.000
No	295 (98.01%)	18 (100.00%)	
yes	6 (1.99%)	0 (0.00%)	
NC	34.10 (32.00, 37.60)	36.15 (34.67, 38.65)	0.050
CSM			1.000
1	299 (99.34%)	18 (100.00%)	
2	2 (0.66%)	0 (0.00%)	
MP			0.112
1	277 (92.03%)	15 (83.33%)	
2	21 (6.98%)	2 (11.11%)	
3	3 (1.00%)	1 (5.56%)	
UBLT			0.077
1	189 (62.79%)	7 (38.89%)	
2	96 (31.89%)	9 (50.00%)	
3	16 (5.32%)	2 (11.11%)	
MMT			0.002
1	99 (32.89%)	0 (0.00%)	
2	56 (18.60%)	2 (11.11%)	
3	138 (45.85%)	15 (83.33%)	
4	8 (2.66%)	1 (5.56%)	
IIG	4.40 (4.00, 5.00)	3.60 (2.55, 4.00)	<0.001
LT	4.50 (4.00, 5.20)	4.00 (3.80, 4.50)	0.015
THD	4.90 (4.00, 5.70)	4.00 (3.28, 4.27)	0.003
HMD	4.34 (0.79)	4.58 (0.90)	0.280
TMD	10.01 (1.09)	8.89 (0.86)	<0.001
SMD	17.97 (1.90)	16.39 (2.06)	0.005
ML	9.00 (8.70, 9.50)	9.15 (8.80, 9.75)	0.399
JD	3.90 (3.50, 4.30)	3.65 (3.50, 4.00)	0.046
DSCM	0.70 (0.60, 0.70)	0.80 (0.70, 0.95)	0.001
DSE	1.90 (1.70, 2.20)	2.00 (1.80, 2.28)	0.083
DSTI	0.70 (0.60, 0.80)	0.85 (0.60, 1.08)	0.068
DSTJ	1.10 (1.00, 1.30)	1.30 (1.00, 1.50)	0.143
DSHB	0.80 (0.70, 1.00)	1.00 (0.83, 1.40)	0.003
DSAC	0.70 (0.50, 0.80)	0.70 (0.60, 0.88)	0.079
DSTR	3.20 (2.80, 3.80)	4.25 (4.00, 4.45)	<0.001

ASA-PS, American Society of Anesthesiologists Physical Status; BMI, body mass index; DM, diabetes mellitus; HBP, hypertension; NC, neck circumference; CSM, cervical spine mobility; MP, mandibular protrusion; UBLT, upper lip bite test; MMT, modified Mallampati test; IIG, inter-incisor gap; LT, length of tongue; THD, thyroid and hyoid distance; HMD, hyomental distance; TMD, thyromental distance, SMD, sternomental distance; ML, mandible length; JD, jaw depth; DSCM, distance from skin to cricothyroid membrane; DSE, distance from skin to epiglottis; DSTI, distance from skin to thyroid isthmus; DSTJ, distance from skin to trachea at jugular notch; DSHB, distance from skin to the hyoid bone; DSAC, distance from skin to skin to anterior commissure of the vocal cord; DSTR, distance from the skin to the tongue root; ASA-PS 1: in good health; ASA-PS 2: with mild comorbidities; ASA-PS 3: with severe comorbidities and limited activity ability; ASA-PS 4: with severe comorbidities and no activity ability; \*: 12 patients with airway masses, 2 patients with obstructive sleep apnea syndrome, and 1 patient with rheumatoid arthritis. \*\*: 4 patients with airway masses and 1 patient with obstructive sleep apnea syndrome.

**Table S3** The characteristics of patients in the validation set

Characteristics	Easy laryngoscopy (n=126)	Difficult laryngoscopy (n=11)	Overall P value
Age	24.75 (21.22, 34.46)	37.10 (27.92, 60.94)	0.036
Gender			0.733
Female	89 (70.63%)	7 (63.64%)	
Male	37 (29.37%)	4 (36.36%)	
ASA-PS			0.022
1	115 (91.27%)	7 (63.64%)	
2	7 (5.56%)	3 (27.27%)	
3	4 (3.17%)	1 (9.09%)	
Height	1.67 (1.62, 1.72)	1.65 (1.59, 1.72)	0.600
Weight	57.00 (50.00, 65.88)	52.50 (49.50, 70.00)	0.748
BMI	20.08 (18.38, 22.82)	20.28 (19.26, 23.37)	0.724
Education			0.035
1	15 (11.90%)	3 (27.27%)	
2	31 (24.60%)	5 (45.45%)	
3	80 (63.49%)	3 (27.27%)	
History of alcohol			0.690
No	101 (80.16%)	10 (90.91%)	
Yes	25 (19.84%)	1 (9.09%)	
History of smoking			0.056
No	110 (87.30%)	7 (63.64%)	
Yes	16 (12.70%)	4 (36.36%)	
History of heart disease			0.287
No	123 (97.62%)	10 (90.91%)	
Yes	3 (2.38%)	1 (9.09%)	
History of lung disease			1.000
No	118 (93.65%)	11 (100.00%)	
Yes	8 (6.35%)	0 (0.00%)	
History of DM			0.346
No	122 (96.83%)	10 (90.91%)	
Yes	4 (3.17%)	1 (9.09%)	
History of HBP			0.099
No	121 (96.03%)	9 (81.82%)	
Yes	5 (3.97%)	2 (18.18%)	
Airway-related diseases			0.045
No	118 (93.65%)	8 (72.73%)	
Yes	8 (6.35%)*	3 (27.27%)**	
History of rhinitis			0.172
No	85 (67.46%)	10 (90.91%)	
Yes	41 (32.54%)	1 (9.09%)	
Nasal obstruction			0.179
0	113 (89.68%)	9 (81.82%)	
1	6 (4.76%)	0 (0.00%)	
2	4 (3.17%)	2 (18.18%)	
3	3 (2.38%)	0 (0.00%)	
History of Snoring			0.312
No	89 (70.63%)	6 (54.55%)	
Yes	37 (29.37%)	5 (45.45%)	
History of radiotherapy and chemotherapy			0.155
No	125 (99.21%)	10 (90.91%)	
Yes	1 (0.79%)	1 (9.09%)	
History of surgery			0.899
No	66 (52.38%)	5 (45.45%)	
Yes	60 (47.62%)	6 (54.55%)	
History of mandibular surgery			0.540
No	118 (93.65%)	10 (90.91%)	
Yes	8 (6.35%)	1 (9.09%)	
History of tumor			0.155
No	119 (94.44%)	9 (81.82%)	
Yes	7 (5.56%)	2 (18.18%)	
History of trauma			1.000
No	123 (97.62%)	11 (100.00%)	
Yes	3 (2.38%)	0 (0.00%)	
Buck teeth			0.540
No	118 (93.65%)	10 (90.91%)	
Yes	8 (6.35%)	1 (9.09%)	
Epiglottis swelling			0.224
No	124 (98.41%)	10 (90.91%)	
yes	2 (1.59%)	1 (9.09%)	
NC	33.00 (31.50, 35.95)	31.60 (31.25, 35.10)	0.394
CSM			1.000
1	125 (99.21%)	11 (100.00%)	
3	1 (0.79%)	0 (0.00%)	
MP			0.108
1	110 (87.30%)	8 (72.73%)	
2	14 (11.11%)	2 (18.18%)	
3	2 (1.59%)	1 (9.09%)	
UBLT			0.012
1	79 (62.70%)	2 (18.18%)	
2	40 (31.75%)	8 (72.73%)	
3	7 (5.56%)	1 (9.09%)	
MMT			<0.001
1	39 (30.95%)	0 (0.00%)	
2	26 (20.63%)	0 (0.00%)	
3	59 (46.83%)	8 (72.73%)	
4	2 (1.59%)	3 (27.27%)	
IIG	4.30 (3.80, 4.80)	2.80 (1.75, 3.50)	<0.001
LT	4.47 (0.96)	3.27 (1.35)	0.015
THD	4.97 (1.10)	4.05 (1.07)	0.018
HMD	4.23 (0.77)	3.88 (0.57)	0.080
TMD	10.00 (9.50, 11.00)	8.50 (7.10, 9.00)	<0.001
SMD	18.28 (1.78)	15.72 (2.03)	0.002
ML	9.02 (0.67)	8.94 (1.04)	0.806
JD	3.84 (0.61)	3.46 (0.41)	0.014
DSCM	0.70 (0.60, 0.70)	0.70 (0.65, 0.70)	0.189
DSE	1.80 (1.60, 2.00)	2.10 (1.70, 2.25)	0.166
DSTI	0.70 (0.52, 0.80)	0.80 (0.70, 0.90)	0.017
DSTJ	1.10 (1.00, 1.30)	1.10 (1.00, 1.25)	0.534
DSHB	0.70 (0.70, 0.90)	1.00 (0.80, 1.05)	0.030
DSAC	0.60 (0.60, 0.70)	0.60 (0.50, 0.70)	0.567
DSTR	3.13 (0.64)	3.99 (0.54)	<0.001

ASA-PS, American Society of Anesthesiologists Physical Status; BMI, body mass index; DM, diabetes mellitus; HBP, hypertension; NC, neck circumference; CSM, cervical spine mobility; MP, mandibular protrusion; UBLT, upper lip bite test; MMT, modified Mallampati test; IIG, inter-incisor gap; LT, length of tongue; THD, thyroid and hyoid distance; HMD, hyomental distance; TMD, thyromental distance, SMD, sternomental distance; DSTI, distance from skin to thyroid isthmus; DSTJ, distance from skin to trachea at jugular notch; DSHB, distance from skin to the hyoid bone; DSAC, distance from skin to anterior commissure of the vocal cord; DSTR, distance from the skin to the tongue root; \* 6 patients with airway masses and 2 patient with obstructive sleep apnea syndrome; \*\* 3 patients with airway masses.