CASE DISCUSSION

Pediatric Obstructive Sleep Apnea Postoperative Respiratory Complications

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01
CASE

Case profile

鄭o萱

Age, Sex	8y, female
Height, Weight	130 cm / 30 kg
BMI	17.75 kg/㎡
Birth Hx	38+3 weeks, 3140 gm
PHx	Denied
FHx	Denied
ABC	Denied
Allergy	Denied

Chief complaint

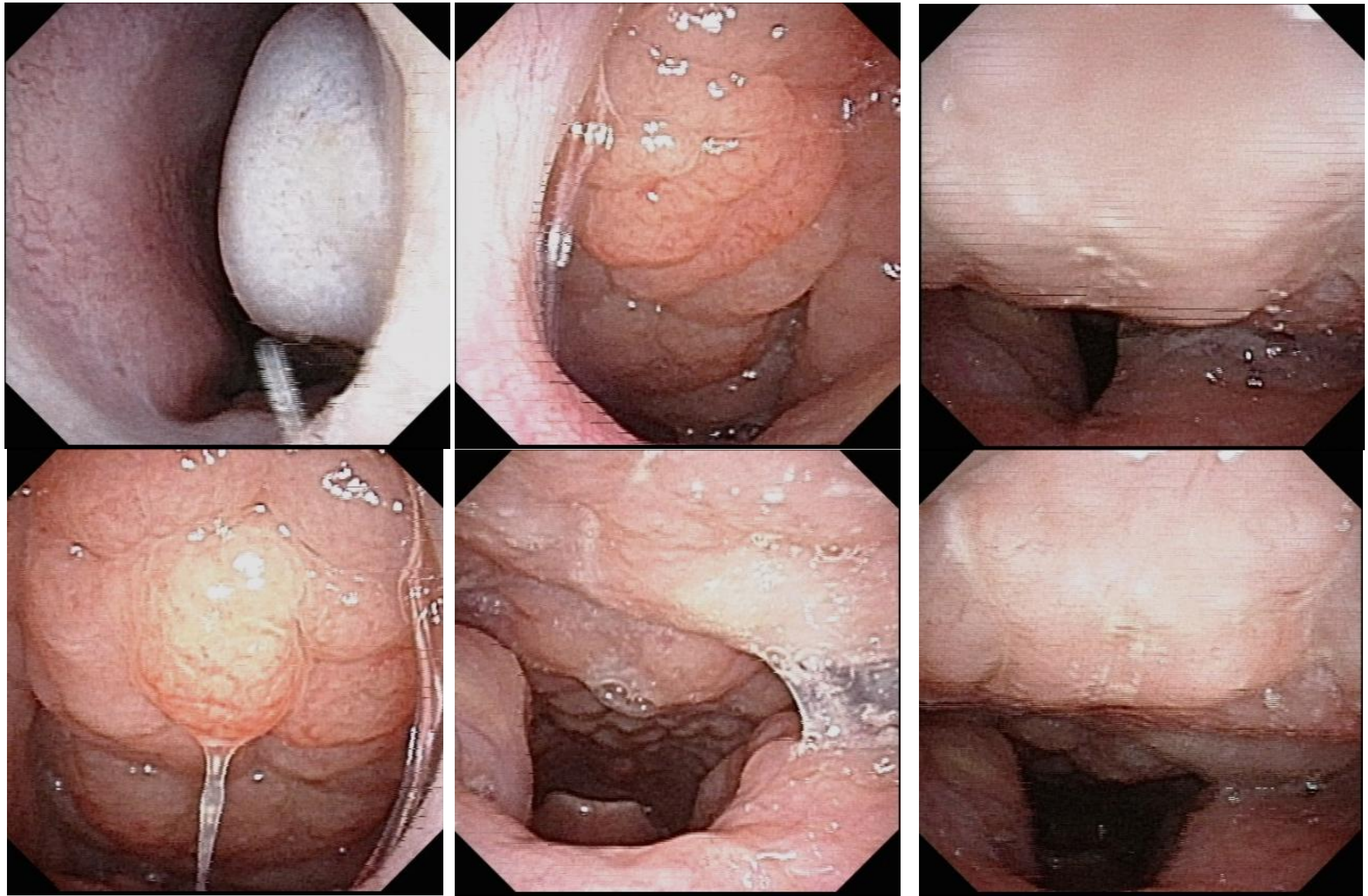
2024-08-01 ENT OPD

snoring while sleeping in recent weeks

Case profile

2024-08-01 ENT OPD

S	Snoring while sleeping noted by her parents in recent weeks Frequent nasal obstruction and rhinorrhea
O	Boggy turbinates Hypertrophic tonsils, R>L, Gr III~IV NPSCopy: NP adenoid vegetation, about 3/4 choanal obstruction, Muller`s maneuver: 90% collapse
A	Suspect OSA
P	HST first



Respiratory Disturbance Index

AHI: 36.0 /h	In REM Stage: 70.5 /h
AI: 2.2	HI: 33.7

Sleep Stage :

Movement time: 0.0 %	REM: 17.7 %
Stage 1: 39.4 %	Stage 2: 21.5 %
Stage 3: 21.5 %	Stage 4: 0.0 %
Time in bed: 626.5 min	Sleep period total: 458.0 min
Total sleep time: 438.0min	Awake time: 20.0 min
Efficiency : 69.9 %	Latency: 168.5 min

Arousal:

Number: 180 counts	Arousal Index: 24.7 per hour

Events:

Obstructive apnea: 14 counts	Total duration: 5.8 min
Central apnea: 1 counts	Total duration: 0.2 min
Mixed apnea: 1counts	Total duration: 0.2 min
Hypopnea: 251 counts	Total duration: 107.4 min
Longest apnea: 48 sec	Longest hypopnea: 73 sec

Oxygen Saturation:

Mean SaO2: 95 %	Mean desaturation: 4 %
Minimum SaO2: 78 %	Total: 209 counts

Snore :

Total: 2045 counts	Snore Index : 280.1 per hour

Cardiac Profile :

Mean heart rate : 91 BPM	Maximum: 105 counts	Minimum: 62 counts

Periodic leg movement :

PLM Total: 0 counts	PLM Index: 0.0/h

Numbre of Apnea + Hypopnea per hour with body position = **Back** : 41.2 count

Sleep with Body position = Back : 200.0 min

Numbre of Apnea + Hypopnea per hour with body position = **non-Back** : 30.1 count

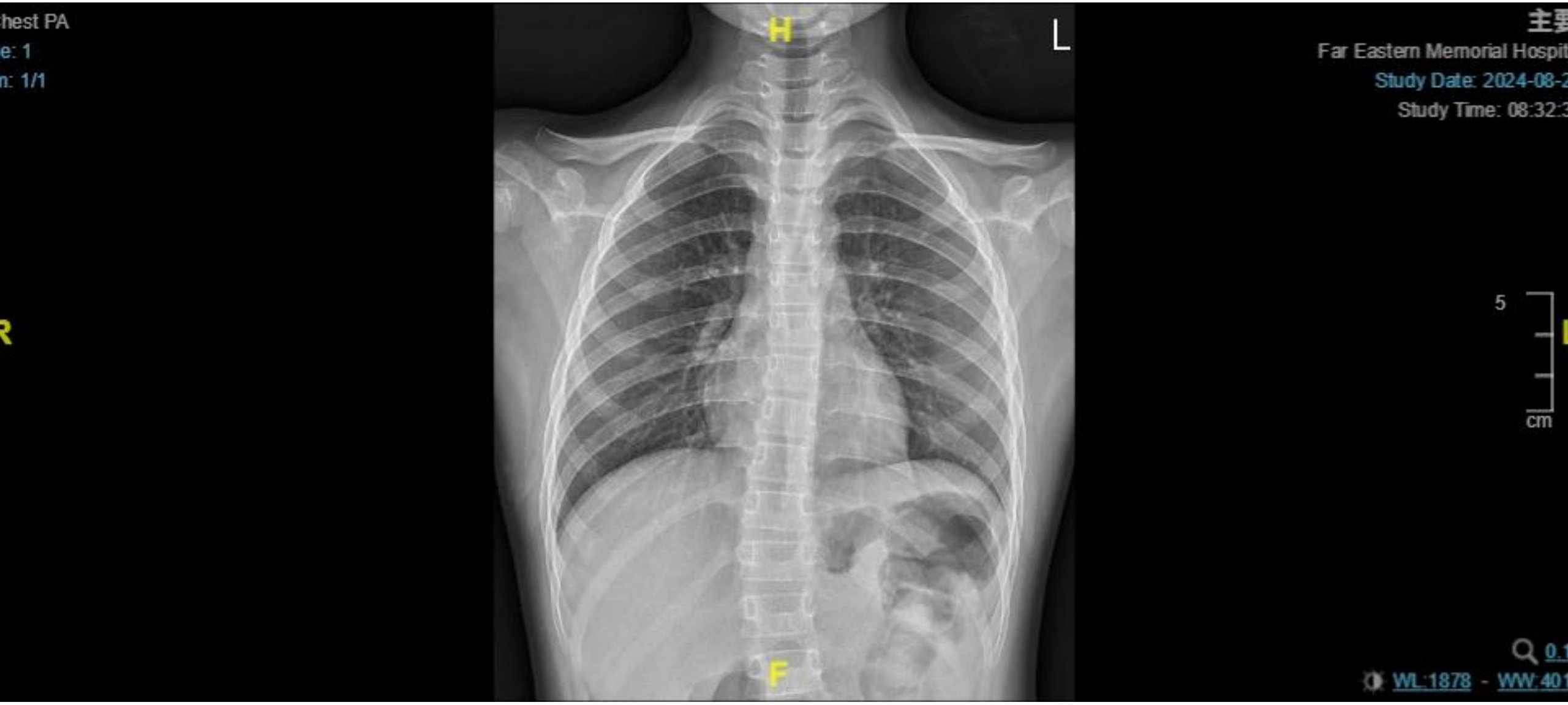
Sleep with Body position = non-Back : 238.0 min

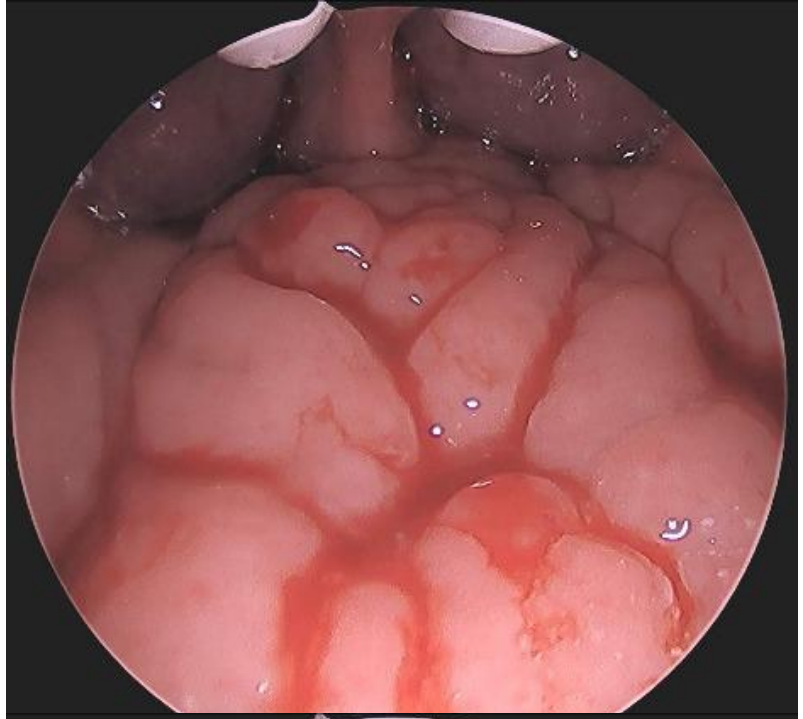
DESATURATION STATISTICS	
Desaturation (%)	Numbr of
>=2	657
>=3	331
>=4	209
>=5	136

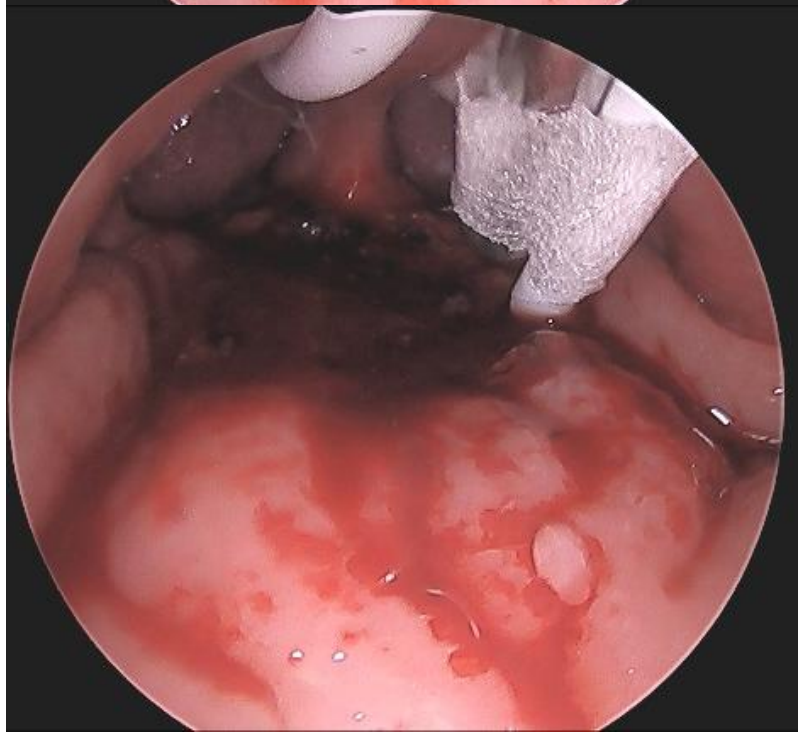
Clinical course 2024

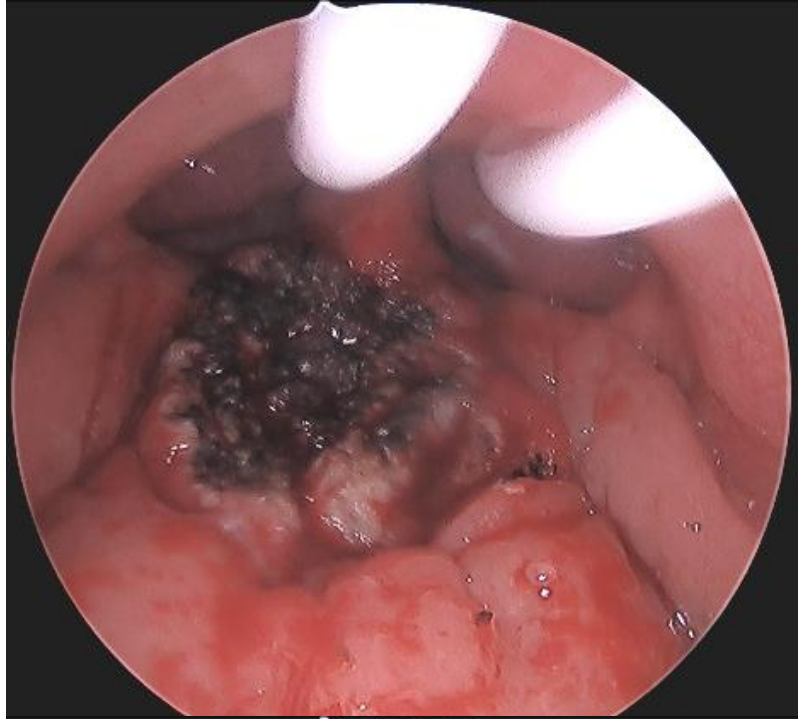
- 8/25 Admission
- 8/26 Adenoidectomy + Bilateral tonsillectomy

8/26 OP day CXR



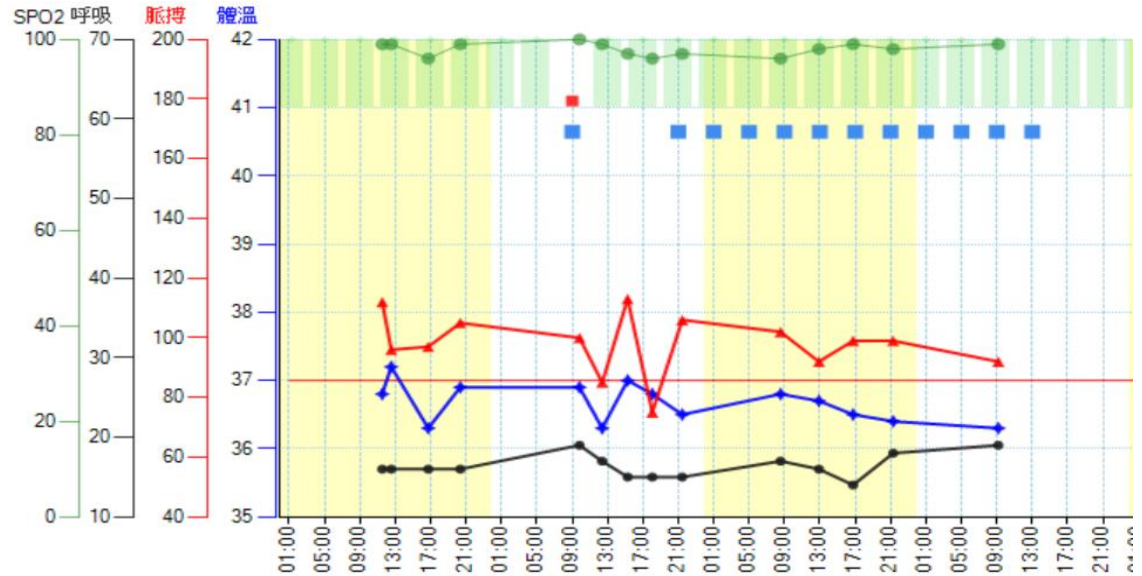






Clinical course 2024

- 8/25 Admission
- 8/26 Adenoidectomy + Bilateral tonsillectomy
- 8/28 Discharge with Amoxicillin

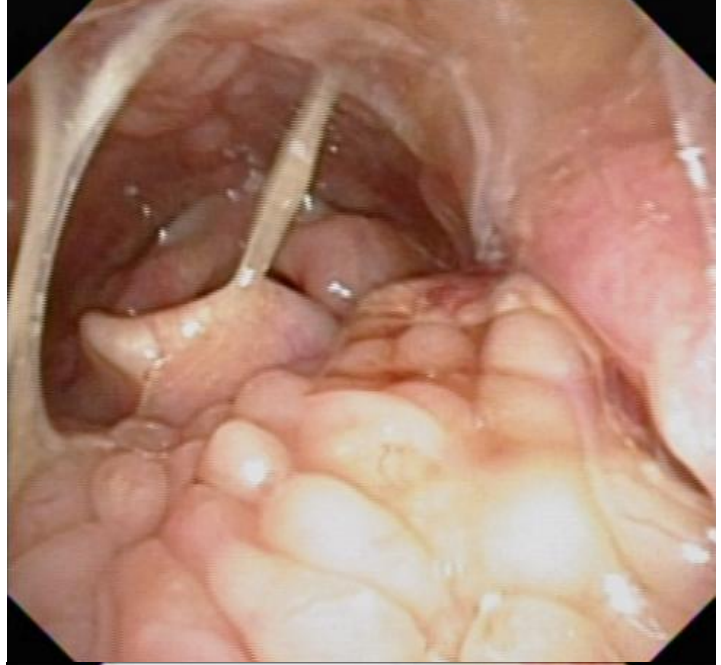


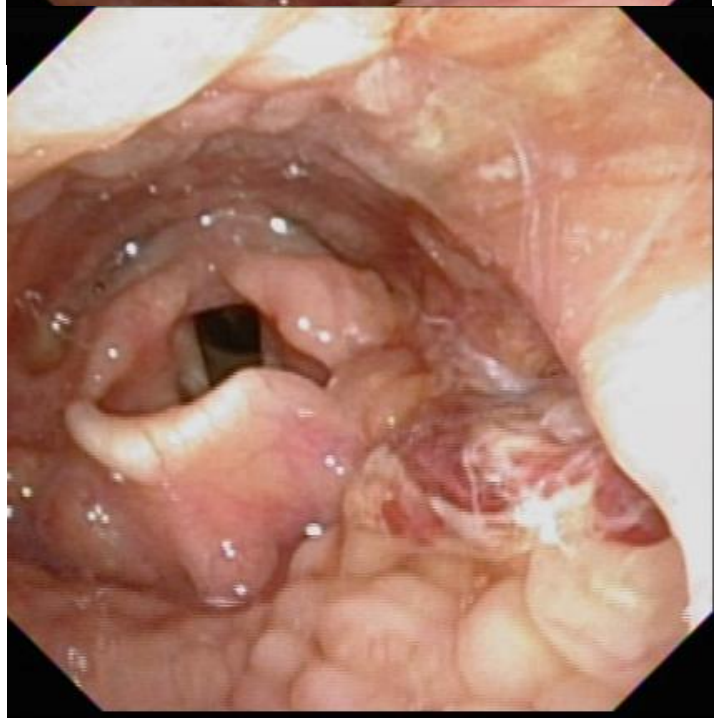
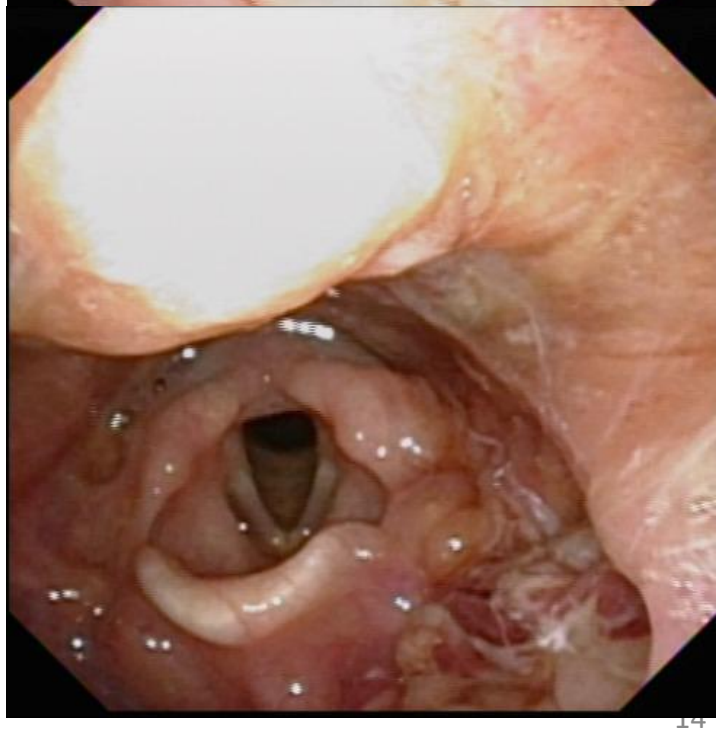
特殊藥品	08/25(日)	08/26(一)	08/27(二)	08/28(三)
Clindamycin (B.B. Injection) 300mg/2ml/amp		D1	D2	
Cefazolin Sodium 1gm/vial		D1		
Amoxicillin Susp. (Amoxigran) 50mg/ml (60ml/bot)			D1	D2

Clinical course 2024

- 8/25 Admission
- 8/26 Adenoidectomy + Bilateral tonsillectomy
- 8/28 Discharge with Amoxicillin
- 9/04 OPD follow-up → Augmentin





Clinical course 2024

- 8/25 Admission
- 8/26 Adenoidectomy + Bilateral tonsillectomy
- 8/28 Discharge with Amoxicillin
- 9/04 OPD follow-up → Augmentin
- 9/08 ER: Fever since 9/07 up to 39°C with productive cough and vomiting

  No diarrhea, rhinorrhea, headache or limb soreness
- 9/10 Ped OPD: still fever up to 40 °C, CXR: RLL pneumonia
- 9/11 Admission

9/10

9/13

9/16

9/10

M. pneumoniae IgM	Blood	8.8 Negative

9/11

Influenza Virus A Ag	鼻咽拭子	Negative
Influenza Virus B Ag	鼻咽拭子	Negative
Adenovirus Ag	鼻咽拭子	Negative
RSV Ag	鼻咽拭子	Negative

9/13

EBV VCA IgG	Blood	<10.0 Negative Negative: <18.0 Equivocal: ≧18.0 - <22.0 Positive: ≧22.0	U/mL
EBV VCA IgM	Blood	<10.0 Negative Negative: <36.0 Equivocal: 36.0 - 43.9 Positive: ≧44.0	U/mL

9/14

SARS-CoV-2 Ag	鼻咽拭子	Negative

WBC (Blood)

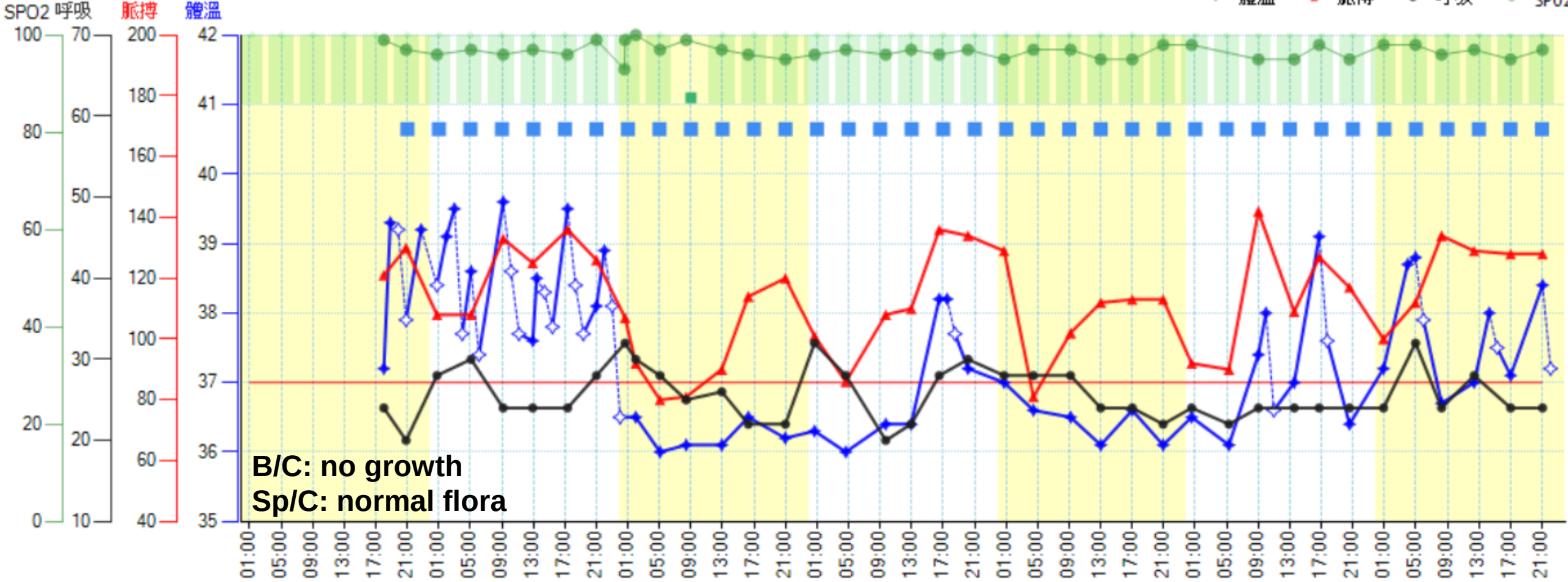
簽收日期	檢查數值	單位
2024-09-16 12:42	18.53	10^3/μL
2024-09-10 14:40	6.00	10^3/μL

CRP (Blood)

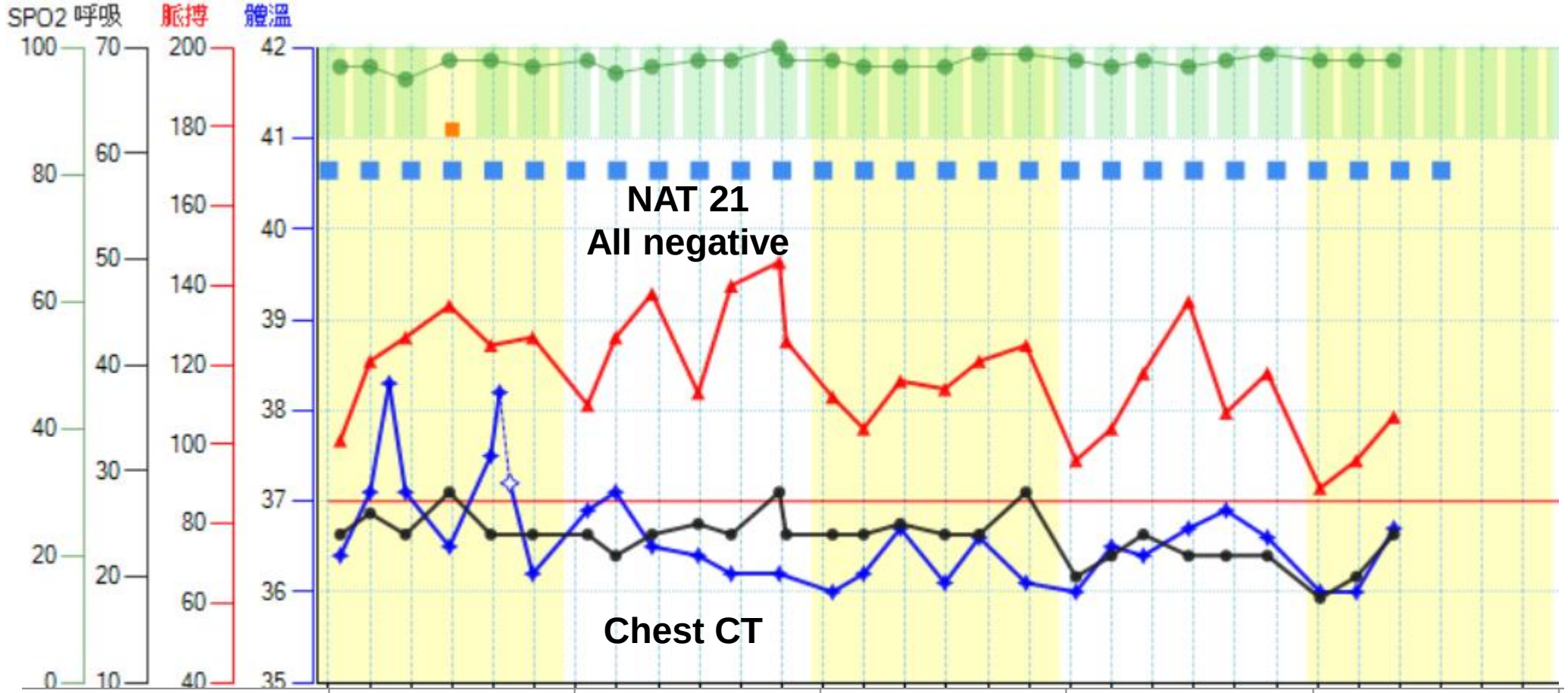
簽收日期	檢查數值	單位
2024-09-16 12:38	1.519	mg/dL
2024-09-10 14:40	2.625	mg/dL

9/19

NAT for 21 Respirato	鼻咽拭子	
Adenovirus	鼻咽拭子	Not Detected
Coronavirus 229E	鼻咽拭子	Not Detected
Coronavirus HKU1	鼻咽拭子	Not Detected
Coronavirus OC43	鼻咽拭子	Not Detected
Coronavirus NL63	鼻咽拭子	Not Detected
Metapneumovirus	鼻咽拭子	Not Detected
Rhinovirus/Enterovir	鼻咽拭子	Not Detected
Influenza A	鼻咽拭子	Not Detected
Influenza A/H1	鼻咽拭子	Not Detected
Influenza A/H1-2009	鼻咽拭子	Not Detected
Influenza A/H3	鼻咽拭子	Not Detected
Influenza B	鼻咽拭子	Not Detected
Parainfluenza 1	鼻咽拭子	Not Detected
Parainfluenza 2	鼻咽拭子	Not Detected
Parainfluenza 3	鼻咽拭子	Not Detected
Parainfluenza 4	鼻咽拭子	Not Detected
RSV	鼻咽拭子	Not Detected
B. pertussis	鼻咽拭子	Not Detected
B. parapertussis	鼻咽拭子	Not Detected
C. pneumoniae	鼻咽拭子	Not Detected
M. pneumoniae	鼻咽拭子	Not Detected
SARS-CoV-2	鼻咽拭子	Not Detected

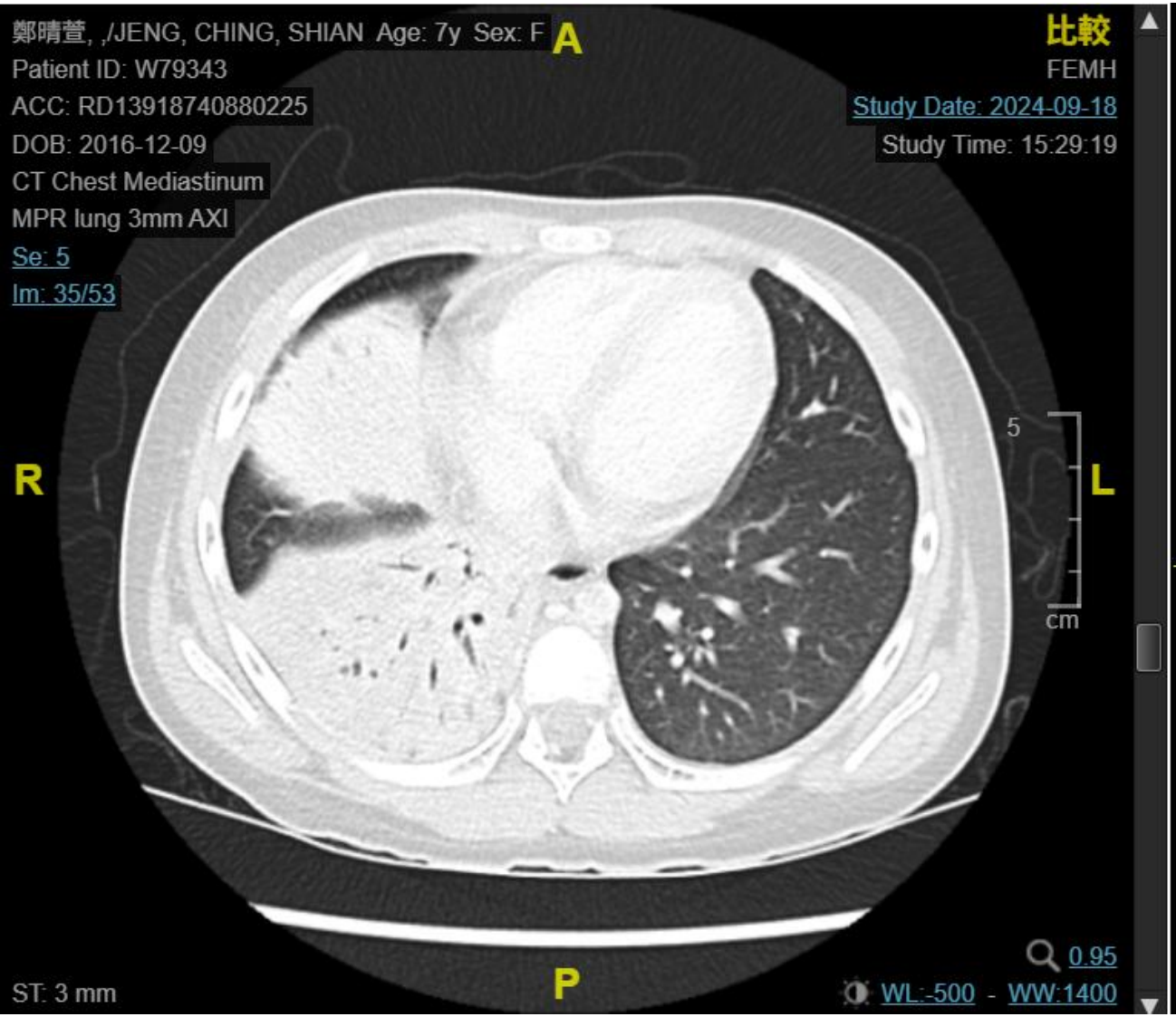


特殊藥品	09/11(三)	09/12(四)	09/13(五)	09/14(六)	09/15(日)	09/16(一)	09/17(二)
Unasyn (Amsulber) 1.5gm/vial	D1	D2	D3	D4	D5	D6	D7
Doxycycline HCl (Doxymycin) 100mg/cap					D1	D2	D3
Azithromycin (Zithromax) Susp. 15ml/bot (200mg/5ml)		D1					
Azithromycin (Aziciin) 250mg/tab			D1	D2			



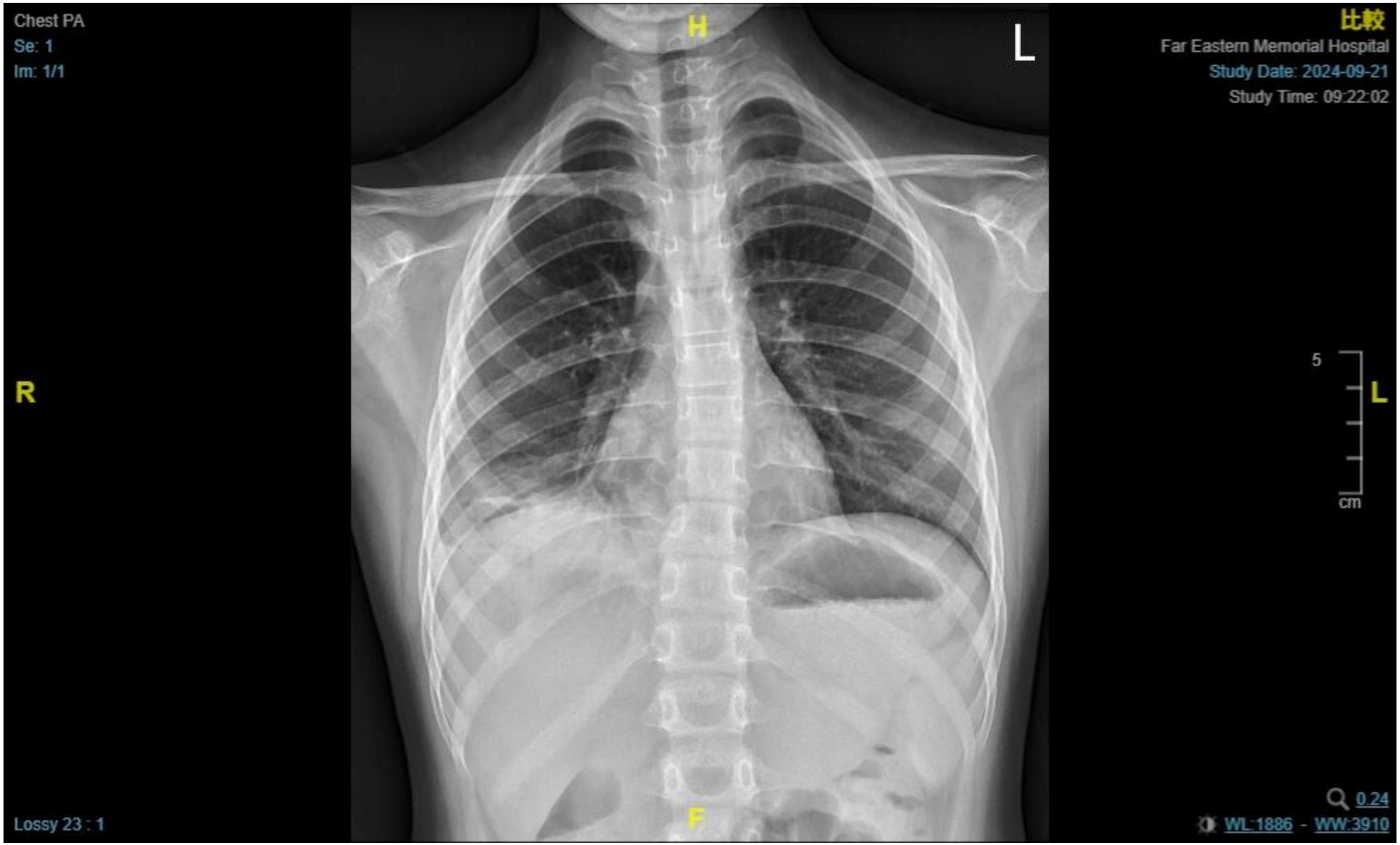
特殊藥品	09/18(三)	09/19(四)	09/20(五)	09/21(六)	09/22(日)
Unasyn (Amsulber) 1.5gm/vial	D8				
Doxycycline HCl (Doxymycin) 100mg/cap	D4	D5	D6	D7	D8
Ceftriaxone (Sintrix) 1gm/vial	D1	D2	D3		
Cefixime (Cexime) 100mg/cap			D1	D2	D3

9/19



Consolidation with air-bronchogram at RLL and RML, suggest lobar pneumonia.

9/21


Chest PA
Se: 1
Im: 1/1
R
Lossy 23 : 1
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L
F
比較
Far Eastern Memorial Hospital
Study Date: 2024-09-21
Study Time: 09:22:02
5
L
cm
0.24
WL:1886 - WW:3910

Clinical course 2024

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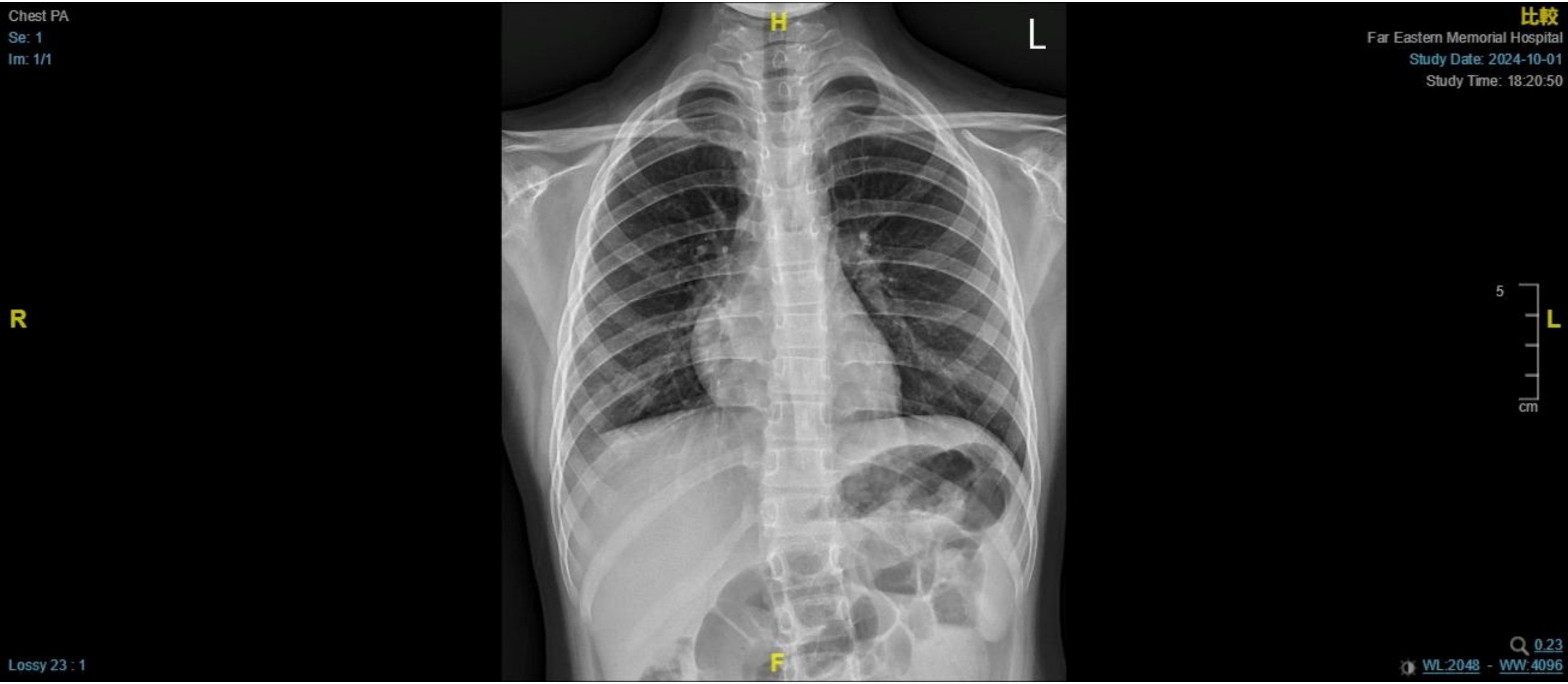
- 9/11~9/22 Admission

10/1


Chest PA
Se: 1
Im: 1/1
H
L
比較
Far Eastern Memorial Hospital
Study Date: 2024-10-01
Study Time: 18:20:50
R
5
L
cm
F
Lossy 23 : 1
0.23
WL:2048 - WW:4096

Final diagnosis

- Obstructive sleep apnea
- Adenoid vegetations status post adenoidectomy on 2024-08-26
- Chronic tonsillitis status post bilateral tonsillectomy on 2024-08-26
- RLL and RML pneumonia, resolved

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Postoperative Respiratory Complications After Adenotonsillectomy in Children With High-Risk Obstructive Sleep Apnea

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IF = 2.5

Introduction

Obstructive Sleep Apnea (OSA)

Affecting 1% to 4% of children

Diagnosis: overnight polysomnogram (PSG). The apnea-hypopnea index (AHI) is the most common metric used to categorize severity

First-Line: Adenotonsillectomy for majority of children with OSA

To date, evidence suggests severe OSA and significant hypoxemia and hypercarbia are at higher risk for postoperative complications

Primary Goal: Identify specific patient characteristics and PSG parameters associated with postoperative respiratory complications after AT among children with high-risk OSA

Primary Outcomes:

1. Major respiratory intervention (e.g., noninvasive positive pressure, intubation)
2. Prolonged hospitalization (admission ≥48 hours)
3. Intensive care unit (ICU) stay

Methods

Study Design: Case series with a retrospective chart review

Setting: A single tertiary care children's hospital

Population: Pediatric patients (<18 years) who had overnight PSG from 2019/1 to 2021/12, identified as "high-risk“

All 11 surgeons but 1 perform total tonsillectomies

Defining "High-Risk"

Inclusion criteria: PSG met at least one:
AHI > 30 events/hour, O_2 nadir < 80%, max CO2 >60 mm Hg, emergent split to positive airway pressure (PAP)

Exclusion criteria:

Age over 18, prior AT, did not undergo AT, or PSG was flagged for non-OSA reasons like arrhythmias or seizures

PSG variables were collected:

- sleep efficiency
- obstructive apnea-hypopnea index (oAHI)
- central AHI
- O2 nadir
- total sleep time (TST) O2 less than 90%, 88%, and 80%
- peak CO2
- average CO2
- percentage of TST with CO2 >50 mm Hg

Results

A total of 15,943 studies were completed

1420 PSGs were labeled as high-risk

307 patients met inclusion criteria

The mean age at the time of surgery was 6.5 years

Table 1. Demographics and Comorbidities of Children With High Risk OSA by Age Group

	Age 0-2, y	Age 2-5, y	Age 5-12, y	Age 12-18, y	*P* value
Total, N (%)	33 (11)	132 (43)	95 (31)	47 (15)	-
Males, N (%)	18 (55)	79 (60)	61 (64)	36 (76)	.15
Race					
White/Caucasian	8 (24)	28 (21)	16 (17)	7 (15)	.009
Black/African-American	19 (58)	53 (40)	23 (24)	18 (38)	
Hispanic	6 (18)	45 (34)	52 (55)	19 (40)	
Other	0	6 (4.5)	4 (4.2)	3 (6.4)	
Trisomy 21	1 (3.0)	9 (6.8)	4 (4.2)	2 (4.3)	.73
Cardiac disease	4 (12)	9 (6.8)	6 (6.3)	1 (2.1)	.36
Asthma	3 (9.1)	27 (20)	11 (12)	10 (21)	.16
Craniofacial	3 (9.1)	6 (4.6)	2 (2.1)	0	.13
MPS	0	0	0	0	-
Sickle cell disease	1 (3.0)	1 (0.8)	1 (1.1)	0	.58
Neuromuscular disease	7 (21)	9 (6.8)	5 (5.3)	2 (4.3)	.02
Achondroplasia	1 (3.0)	1 (1.5)	0	0	.36
BMI z score, mean (SD)	0.9 (1.8)	1.1 (2.2)	2.4 (1.2)	2.5 (0.8)	<.001
BMI% 95th, mean (SD)	-	133 (25)	134 (23)	134 (24)	.92
Sleep efficiency	76.7 (15.3)	83.4 (43.7)	80.1 (12.7)	76.8 (12.5)	.50
oAHI	28.1 (26.7)	33.6 (25.0)	36.0 (22.3)	47.4 (28.8)	.003
CAI	1.6 (2.6)	0.8 (1.0)	0.6 (1.1)	0.9 (2.1)	.01
O_2 nadir	71.7 (8.2)	71.7 (9.3)	75.3 (9.9)	77.2 (9.3)	.001
TST O_2 <90%	21.4 (30.8)	23.8 (30.5)	20.7 (27.4)	20.0 (31.6)	.83
TST O_2 <88%	9.7 (14.3)	13.1 (18.1)	10.6 (14.7)	10.8 (18.4)	.58
TST O_2 <80%	2.6 (5.1)	4.5 (9.1)	3.4 (7.4)	2.7 (7.6)	.44
Peak CO_2	52.3 (5.7)	53.2 (7.6)	53.0 (4.9)	52.4 (4.5)	.80
% TST CO_2 >50 mm Hg	6.8 (12.0)	10.9 (19.4)	9.0 (17.1)	9.2 (18.9)	.64

Abbreviations: BMI, body mass index; CAI, central apnea index; MPS, mucopolysaccharidosis; oAHI, obstructive apnea-hypopnea index; OSA, obstructive sleep apnea; SD, standard deviation; TST, total sleep time; %BMIp95, BMI as a percentage of the 95th percentile based on sex and age.

Baseline characteristics

BMI z score was significantly higher in the 5 to 12 and 12 to 18 year age groups (2.4 and 2.5, P < .001)

Obstructive AHI (oAHI): increased with each consecutive age group (P=.003)

O_2 Nadir: increased with each consecutive age group (P=.001).

Overall Postoperative Complication Rates

- Major Respiratory Intervention: 25 patients (8.1%)
- Prolonged Admission > 48 hours: 49 patients (16%)
- ICU Admission: 29 patients (9.4%)

Major Interventions

Patient Characteristics:

Higher BMI z-score (3.1 vs 1.7, P<.001) and %BMIp95 (148 vs 132, P = .01)

Comorbidities: Cardiac disease (20%, P<.01), craniofacial disease (12%, P=.02), and neuromuscular disease (24%, P=.001)

PSG Parameters:

Nearly all PSG markers of severity

Table 2. Association Between Patient Demographics and Preoperative PSG Findings With Postoperative Major Interventions

	Major intervention (N = 25, 8.1%)	No intervention (N = 282, 92%)	*P* value
Males	17 (68)	177 (63)	.60
Race			
White/Caucasian	3 (12)	56 (20)	.41
Black/African-American	13 (52)	100 (35)	
Hispanic	8 (32)	114 (40)	
Other	1 (4.0)	12 (4.3)	
Trisomy 21	0	16 (5.7)	.22
Cardiac disease	5 (20)	15 (5.3)	.004
Asthma	3 (12)	48 (17)	.52
Craniofacial	3 (12)	8 (2.8)	.02
MPS	0	0	-
Sickle cell disease	0	3 (1.0)	.60
Neuromuscular disease	6 (24)	17 (6.0)	.001
Achondroplasia	1 (4.0)	2 (0.7)	.11
BMI z score, mean (SD)	3.1 (2.4)	1.7 (1.7)	<.001
BMI% 95th, mean (SD)	148 (24)	132 (23)	.01
Sleep efficiency	79.8 (13.9)	80.7 (31.4)	.88
oAHI	50.1 (36.9)	34.6 (23.9)	.003
CAI	0.4 (0.1)	0.9 (1.5)	.13
O_2 nadir	64.7 (12.7)	74.4 (8.9)	<.001
TST O_2 <90%	60.4 (53.9)	18.6 (23.8)	<.001
TST O_2 <88%	34.2 (32.5)	9.6 (12.9)	<.001
TST O_2 <80%	13.6 (13.4)	2.8 (6.7)	<.001
Peak CO_2	56.5 (5.0)	52.6 (6.2)	.003
% TST CO_2 >50 mm Hg	25.4 (31.7)	8.2 (15.5)	<.001

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% TST CO_2 >50 mm Hg	25.4 (31.7)	8.2 (15.5)	<.001

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Prolonged Admission (>48h)

49 (16%) required and only 6 were for non-respiratory reasons

Patient Characteristics: achondroplasia (P<.001)

PSG Parameters:

Nearly all PSG markers of severity except for oAHI (40.0 vs 35.1, P = .21)

Table 3. Association Between Patient Demographics and Preoperative PSG Findings With Prolonged Postoperative Admission (>48 hours)

	Admit >48 h (N = 49, 16%)	Admit <48 h (N = 258, 84%)	*P* value
Males	27 (55)	167 (65)	.20
Race			
White/Caucasian	6 (12)	53 (21)	.08
Black/African-American	26 (53)	87 (34)	
Hispanic	15 (31)	107 (41)	
Other	2 (4.1)	11 (4.3)	
Trisomy 21	4 (8.2)	12 (4.7)	.31
Cardiac disease	6 (12)	14 (5.4)	.08
Asthma	10 (20)	41 (16)	.44
Craniofacial	4 (8.2)	7 (2.7)	.06
MPS	0	0	-
Sickle cell disease	1 (2.0)	2 (0.8)	.41
Neuromuscular disease	7 (14)	16 (6.2)	.05
Achondroplasia	3 (6.1)	0	<.001
BMI z score, mean (SD)	1.9 (2.4)	1.8 (1.7)	.64
BMI% 95th, mean (SD)	141 (29)	133 (23)	.17
Sleep efficiency	78.3 (13.1)	81.1 (32.6)	.56
oAHI	40.0 (33.6)	35.1 (23.6)	.21
CAI	0.6 (1.0)	0.9 (1.6)	.30
O_2 nadir	67.8 (10.0)	74.7 (9.1)	<.001
TST O_2 <90%	43.0 (44.9)	18.0 (23.9)	<.001
TST O_2 <88%	23.5 (25.9)	9.3 (13.3)	<.001
TST O_2 <80%	8.4 (11.5)	2.8 (6.9)	<.001
Peak CO_2, mm Hg (SD)	54.9 (6.3)	52.6 (6.2)	.02
% TST CO_2 >50 mm Hg	17.3 (25.9)	8.2 (15.6)	.001

Abbreviations: BMI, body mass index; CAI, central apnea index; MPS, mucopolysaccharidosis; oAHI, obstructive apnea-hypopnea index; PSG, polysomnogram; SD, standard deviation; TST, total sleep time; %BMIp95, BMI as a percentage of the 95th percentile based on sex and age.

ICU Admission

29 (9.4%) required. Of these 29, 10 (34.5%) were planned prior to admission. Of these 10, 5 required a major intervention

Patient Characteristics:

Higher BMI z-score (2.6 vs 1.7, P = .03)

Craniofacial disorders (14%, P=.002)

Neuromuscular disease (21%, P=.005)

PSG Parameters:

Nearly all PSG markers of severity

Table 4. Association Between Patient Demographics and Preoperative PSG Findings With Postoperative ICU Admission

	ICU (N = 29, 9.4%)	No ICU (N = 278, 91%)	*P* value
Males	20 (69)	174 (63)	.50
Race			
White/Caucasian	6 (21)	53 (19)	.14
Black/African-American	15 (52)	98 (35)	
Hispanic	6 (21)	116 (42)	
Other	2 (6.9)	11 (4.0)	
Trisomy 21	1 (3.5)	15 (5.4)	.65
Cardiac disease	4 (14)	16 (5.8)	.10
Asthma	3 (10)	48 (17)	.34
Craniofacial	4 (14)	7 (2.5)	.002
MPS	0	0	-
Sickle cell disease	0	3 (1.1)	.57
Neuromuscular disease	6 (21)	17 (6.1)	.005
Achondroplasia	3 (10)	0	<.001
BMI z score, mean (SD)	2.6 (2.4)	1.7 (1.8)	.03
BMI% 95th, mean (SD)	140 (30)	133 (23)	.31
Sleep efficiency	78.8 (13.7)	80.8 (31.6)	.73
oAHI	48.8 (37.2)	34.5 (23.6)	.004
CAI	0.6 (0.9)	0.9 (1.5)	.39
O_2 nadir	64.8 (10.3)	74.6 (9.0)	<.001
TST O_2 <90%	51.5 (48.2)	18.9 (25.3)	<.001
TST O_2 <88%	28.8 (28.5)	9.8 (13.9)	<.001
TST O_2 <80%	11.3 (12.6)	2.9 (7.0)	<.001
Peak CO_2	56.8 (5.0)	52.5 (6.2)	<.001
% TST CO_2 >50 mm Hg	22.3 (30.0)	8.3 (15.7)	<.001

Abbreviations: BMI, body mass index; CAI, central apnea index; ICU, intensive care unit; MPS, mucopolysaccharidosis; oAHI, obstructive apnea-hypopnea index; PSG, polysomnogram; SD, standard deviation; TST, total sleep time; %BMIp95, BMI as a percentage of the 95th percentile based on sex and age.

Postoperative Outcomes by Age Group

Table 5. Postoperative Outcomes in High-Risk OSA Patients Following AT

	Age 0-2, y	Age 2-5, y	Age 5-12, y	Age 12-18, y	*P* value
Total hospital length of stay, d (SD)	1.7 (1.5)	1.7 (2.1)	1.2 (0.9)	1.1 (0.4)	.03
ICU admission, N (%)	7 (22)	15 (12)	6 (6.5)	1 (2.1)	.02
Length of ICU stay, d (SD)	0.6 (1.6)	0.4 (1.6)	0.2 (0.9)	0.0 (0.2)	.25
Major intervention, N (%)	4 (12)	11 (8.3)	8 (8.4)	2 (4.3)	.65
+RVP during admission, N (%)	4 (12)	8 (6.2)	2 (2.1)	0	.04
Admission >48 h, N (%)	12 (36)	27 (20)	9 (9.5)	1 (2.1)	<.001

Abbreviations: AT, adenotonsillectomy; ICU, intensive care unit; OSA, obstructive sleep apnea; RVP, respiratory viral panel.

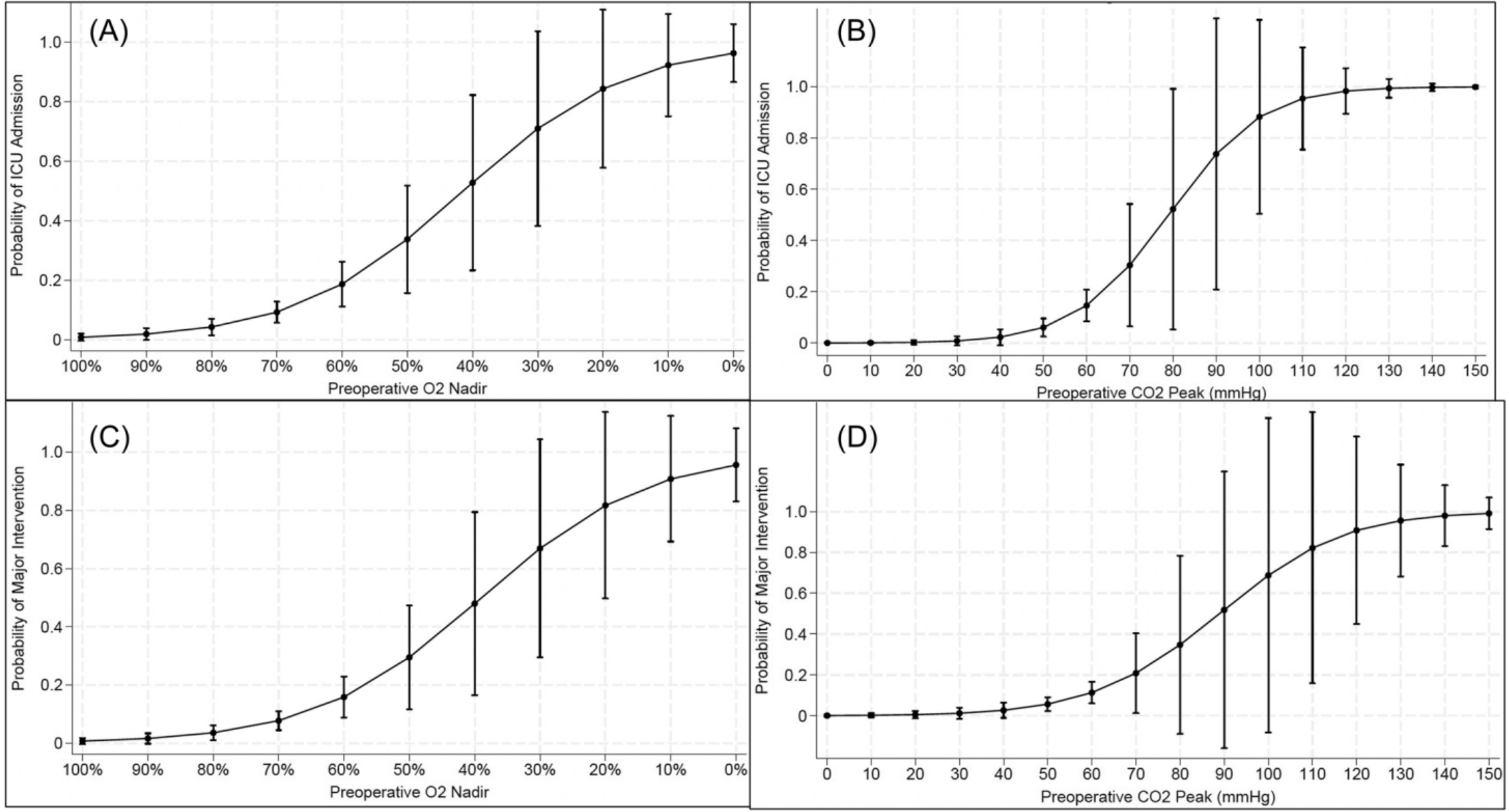

Figure 1. Logistical regression models for major interventions and ICU admission based on preoperative O_2 nadir and peak CO_2 with 95% confidence intervals. (A) Logistical regression model for probability of ICU admission based on preoperative O_2 nadir. (B) Logistical regression model for probability of ICU admission based on preoperative peak CO_2. (C) Logistical regression model for probability of major intervention based on preoperative O_2 nadir. (D) Logistical regression model for probability of major intervention based preoperative peak CO_2. ICU, intensive care unit.

Discussion

- Higher AHI, O_2, and CO_2 parameters had the highest association with postoperative complications
- Patient factors were identified as high-risk: Obesity, neuromuscular and cardiac disease were linked to major respiratory intervention
- Younger age (0-2 years) was a primary driver for requiring ICU and longer hospital stay

Complication rates in this study were higher than those reported in general pediatric OSA population

- Major intervention rate: 8.1% vs. 1.7%-5.8% in other large studies
- ICU admission rate: 9.7% vs. 3.2% in another study of severe OSA

The finding that neuromuscular disease, high peak CO_2, and low O_2 nadir are risk factors for ICU admission aligns with the findings of previous studies

Study Limitations

- Retrospective Design: inherent biases and potential errors in the medical record
- Single-Center: The demographics, racial distribution, and practice patterns may not be generalizable to other centers
- Sample Size: complications are relatively rare, so the sample size may be insufficient to fully examine all risk factors

Clinical Otolaryngology

ORIGINAL ARTICLE

Revisits after adenotonsillectomy in children with sleep-disordered breathing: A retrospective single-institution study

I.-S. Chang, K.-T. Kang, C.-C. Tseng, W.-C. Weng, T.-Y. Hsiao, P.-L. Lee, W.-C. Hsu

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IF = 1.5

Methods

- Retrospective single-institution
- Population: 610 children (<18 y) with sleep-disordered breathing (SDB) who underwent adenotonsillectomy
- Period: 2007–2015
- **Main outcomes**: ER revisit and hospital readmission within 30 days after surgery

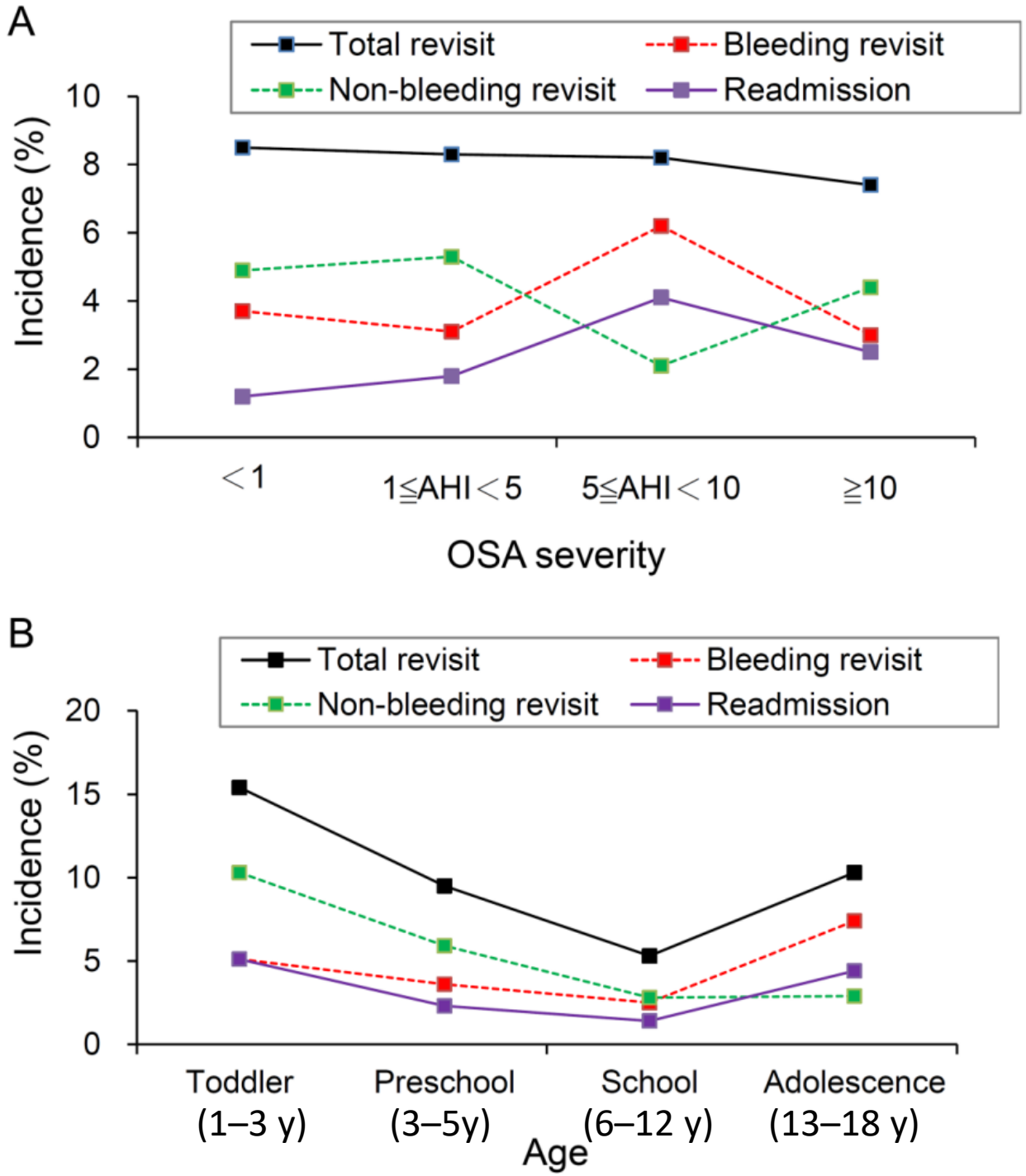
- SDB severity defined by AHI from polysomnography
  - Primary snoring (AHI < 1)
  - Mild OSA (AHI = 1–5)
  - Moderate OSA (AHI = 5–10)
  - Severe OSA (AHI > 10)
- Tonsillectomies: coblation method or cold-steel knife
- Adenoidectomies: microdebrider-assisted method
- All surgical procedures were performed under general anaesthesia with 2-day hospitalization

Results

Variable	Non-return ER (n = 561)	Return ER (n = 49)	P†
Age, year	7.2±3.3	7.0±3.8	0.063
Toddler	33 (5.9)	6 (12.2)	
Preschool	201 (35.8)	21 (42.9)	
School	266 (47.4)	15 (30.6)	
Adolescence	61 (10.9)	7 (14.3)	
Gender, %			0.621
Male	399 (71.1)	37 (75.5)	
Female	162 (28.9)	12 (24.5)	
Obese, %	137 (24.4)	14 (28.6)	0.495
AHI, event/hr	11.4±16.6	8.5±12.3	0.974
＜1	75 (13.4)	7 (14.3)	
1≦AHI＜5	209 (37.3)	19 (38.8)	
5≦AHI＜10	89 (15.9)	8 (16.3)	
≧10	188 (33.5)	15 (30.6)	
ICU stay	1 (0.2)	5 (10.2)	**<0.001**
Operative technique			1.000
Coblation	499 (88.9)	44 (89.8)	
Cool steel	62 (11.1)	5 (10.2)	

Abnormal blood test	5 (0.9)	1 (2.0)	0.396
Nasal surgery	13 (2.3)	0 (0.0)	0.614
Grommet	35 (6.2)	5 (10.2)	0.359
Surgical time, min	99.6±26.9	102.1±30.4	**0.034**
<90 min	213 (38.0)	18 (36.7)	
90-120 min	257 (45.8)	16 (32.7)	
>120 min	91 (16.2)	15 (30.6)	
Blood loss			0.833
≤ 10 ml	465 (82.9)	43 (87.8)	
11-50 ml	79 (14.1)	5 (10.2)	
> 50 ml	17 (3.0)	1 (2.0)	
Inject steroid	72 (12.8)	5 (10.2)	0.822
ASA			**0.012**
1/2	508 (90.6)	38 (77.6)	
3/4	53 (9.4)	11 (22.4)	

† Fisher's exact test

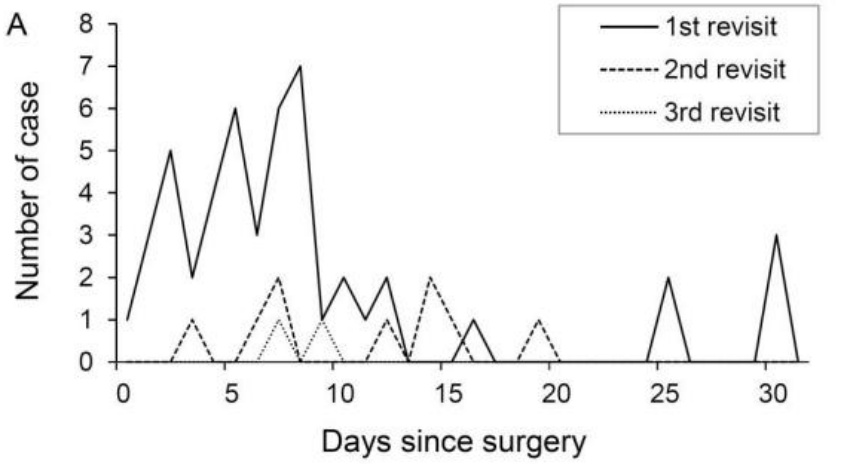

A
Total revisit
Bleeding revisit
Non-bleeding revisit
Readmission
Incidence (%)
0
2
4
6
8
10
<1
1≦AHI<5
5≦AHI<10
≧10
OSA severity
B
Total revisit
Bleeding revisit
Non-bleeding revisit
Readmission
Incidence (%)
0
5
10
15
20
Toddler
(1–3 y)
Preschool
(3–5y)
School
(6–12 y)
Adolescence
(13–18 y)
Age

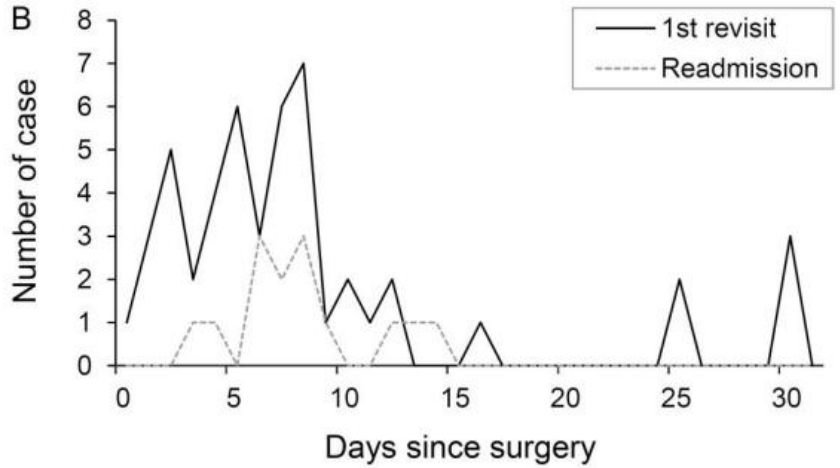
- The ER-return group had significantly:
  - Higher prevalence of ICU stays (10.2% vs 0.2%, P < .001)
  - Longer surgical times (102.1 ± 30.4 min vs 99.6 ± 26.9 min, P = .034)
  - Higher ASA scores (P = .012)
- **No** association between OSA severity and the total revisit rate
- The younger, the higher non-bleeding-related ER revisits (P = .025)

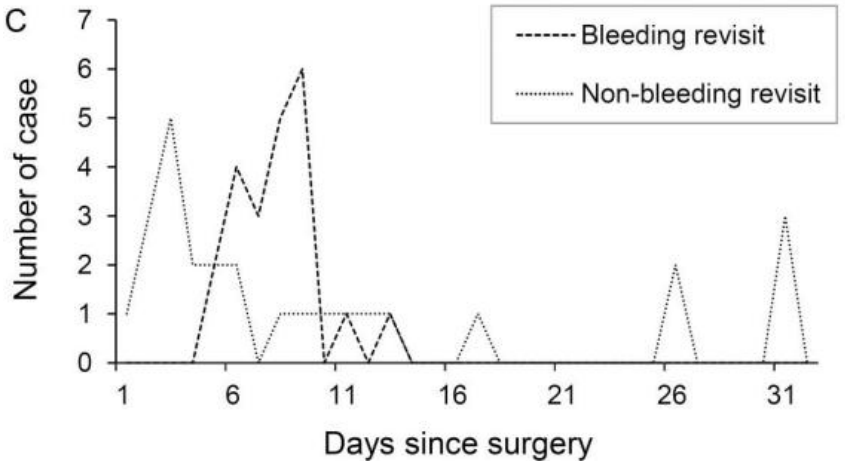
Cause	ER Revisit		
	First (*n* = 49) †	Second (*n* = 9)	Third (*n* = 1)
Bleeding	22	7	1
Pain	8	0	0
Nausea / vomit	3	0	0
Dehydration	4	0	0
Fever / infection / pneumonia	8	2	0
Unrelated to surgery	14	0	0

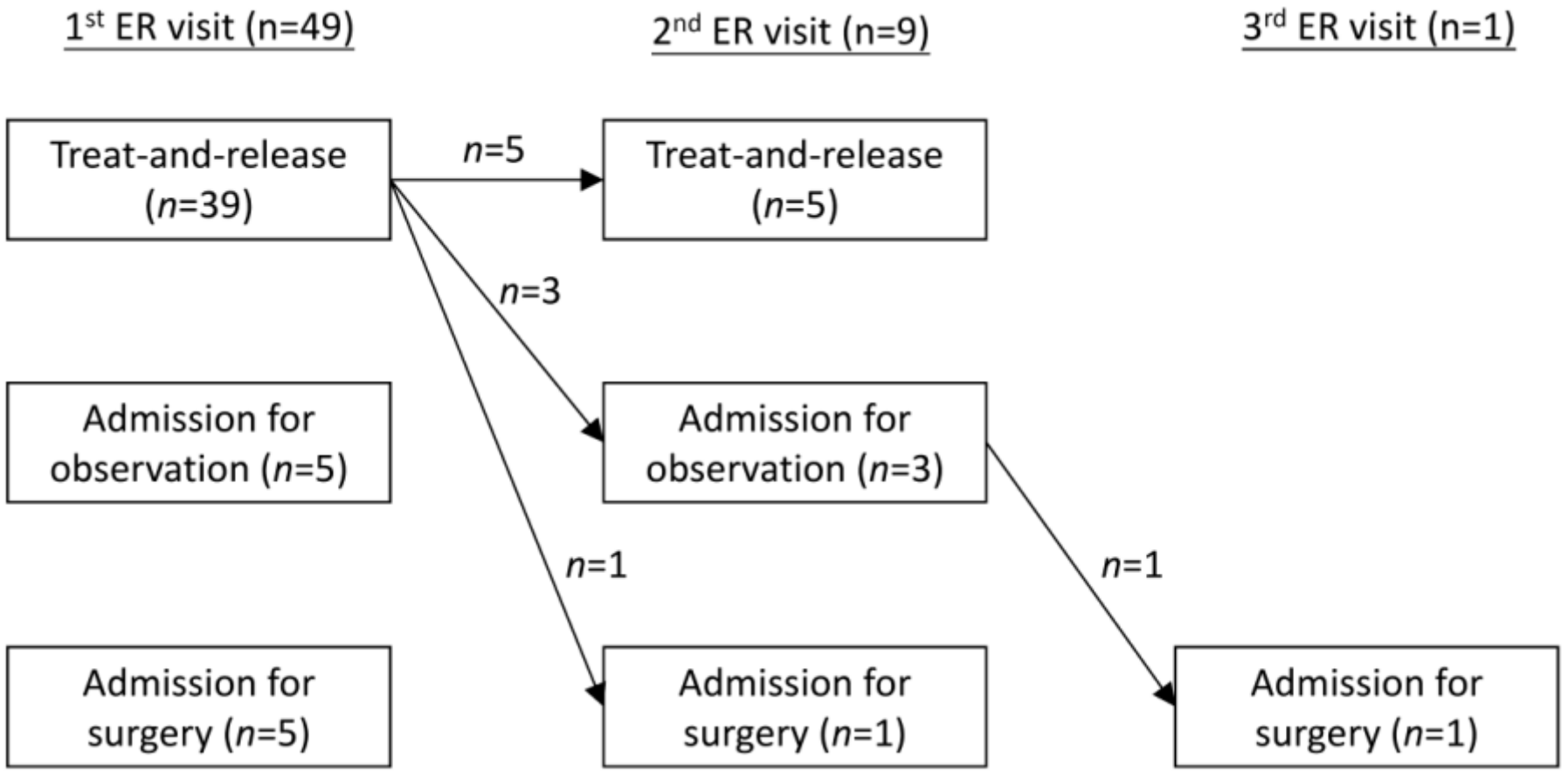
Note: † Allow multiple causes for first revisit.

- Of the 610 children, 49 (8.0%) had first ER revisit, 9 (1.5%) had second
- Mean interval between surgery and first ER revisit was 8.2 ± 7.5 days
- Mean interval between surgery and second ER revisit was 10.8 ± 5.2 days
- Mean interval between surgery and readmission was 7.9 ± 3.2 days
- Mean duration between surgery and ER revisit for bleeding-related causes was 6.9 ± 1.9 days
- Mean duration between surgery and an ER revisit for non-bleeding-related causes was 9.3 ± 10.0 days


A
Number of case
Days since surgery
1st revisit
2nd revisit
3rd revisit


B
Number of case
Days since surgery
1st revisit
Readmission


C
Number of case
Days since surgery
Bleeding revisit
Non-bleeding revisit


1st ER visit (n=49)
2nd ER visit (n=9)
3rd ER visit (n=1)
Treat-and-release (n=39)
n=5
Treat-and-release (n=5)
n=3
Admission for observation (n=5)
Admission for observation (n=3)
n=1
n=1
Admission for surgery (n=5)
Admission for surgery (n=1)
Admission for surgery (n=1)

Multilogistic regression model

- Age < 3y (OR = 4.13; 95% CI 1.08–15.80) had an 4-fold increased risk of a non-bleeding-related revisit
- ICU stay (odds ratio [OR] = 36.97; 95% CI 3.71–368.24) significantly increased the risk of ER revisits
- ICU stay (OR = 73.89; 95% CI 6.30–867.25) and high ASA score (OR = 3.24; 95% CI 1.05–9.95) increased risk of bleeding-related ER revisits

Variable	Total revisit		Bleeding revisit		Non-bleeding revisit	
	Event (%)	OR (95% CI)	Event (%)	OR (95% CI)	Event (%)	OR (95% CI)
Age						
Toddler	6 (15.4)	2.08 (0.61–7.05)	2 (5.1)	0.43 (0.03–5.62)	4 (10.3)	**4.13 (1.08–15.80)***
Preschool	21 (9.5)	1.91 (0.94–3.90)	8 (3.6)	1.23 (0.40–3.75)	13 (5.9)	2.40 (0.96–5.99)
School	15 (5.3)	1 (Reference)	7 (2.5)	1 (Reference)	8 (2.8)	1 (Reference)
Adolescence	7 (10.3)	1.82 (0.66–5.00)	5 (7.4)	3.20 (0.86–11.97)	2 (2.9)	0.90 (0.18–4.51)
Gender						
Male	37 (8.5)	1.31 (0.64–2.70)	18 (4.1)	1.97 (0.60–6.47)	19 (4.4)	0.94 (0.39–2.26)
Female	12 (6.9)	1 (Reference)	4 (2.3)	1 (Reference)	8 (4.6)	1 (Reference)
OSA severity						
AHI＜1	7 (8.5)	1 (Reference)	3 (3.7)	1 (Reference)	4 (4.9)	1 (Reference)
1≦AHI＜5	19 (8.3)	0.96 (0.37–2.48)	7 (3.1)	0.99 (0.22–4.47)	12 (5.3)	0.95 (0.29–3.12)
5≦AHI＜10	8 (8.2)	0.68 (0.21–2.18)	6 (6.2)	1.45 (0.28–7.40)	2 (2.1)	0.29 (0.05–1.76)
AHI≧10	15 (7.4)	0.65 (0.24–1.78)	6 (3.0)	0.56 (0.11–2.82)	9 (4.4)	0.76 (0.22–2.65)

Variable	Total revisit		Bleeding revisit		Non-bleeding revisit	
	Event (%)	OR (95% CI)	Event (%)	OR (95% CI)	Event (%)	OR (95% CI)
ICU stay						
No	44 (7.3)	1 (Reference)	18 (3.0)	1 (Reference)	26 (4.3)	1 (Reference)
Yes	5 (83.3)	**36.97 (3.71–368.24)****	4 (66.7)	**73.89 (6.30–867.25)****	1 (16.7)	2.18 (0.16–28.87)
Surgical time						
<90 min	18 (7.8)	1 (Reference)	9 (3.9)	1 (Reference)	9 (3.9)	1 (Reference)
90-120 min	16 (5.9)	0.77 (0.37–1.57)	6 (2.2)	0.50 (0.17–1.50)	10 (3.7)	1.06 (0.42–2.70)
>120 min	15 (14.2)	1.57 (0.69–3.57)	7 (6.6)	0.75 (0.21–2.70)	8 (7.5)	2.46 (0.86–7.04)
ASA						
1/2	38 (7.0)	1 (Reference)	15 (2.7)	1 (Reference)	23 (4.2)	1 (Reference)
3/4	11 (17.2)	1.87 (0.81–4.34)	7 (10.9)	**3.24 (1.05–9.95)***	4 (6.3)	1.20 (0.36–4.02)

Note: OR = odds ratio; CI = confidence interval; *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$

Discussion

- Primary haemorrhaging occurs within the first 24 hours
- Secondary haemorrhaging originates from the sloughing of eschar, trauma because of food ingestion, or tonsil infection, is mostly recognized in postoperative day 6
- Non-bleeding-related revisits including pain, nausea, vomiting, and dehydration, causing disparities in the timing of revisits

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Thieme

Int Arch Otorhinolaryngol. 2021 Feb 19;25(4):e545–e550. doi: 10.1055/s-0040-1722159

The Associations of Tonsillectomy with Adenoidectomy with Pneumonia and Appendicitis Based on National Sample Cohort Data from the Korean National Health Insurance Service

Junhui Jeong [1], Jung Kyu Choi [2], Hyun Seung Choi [1], Chang Eui Hong [1], Hyang Ae Shin [1], Jung Hyun Chang [1,✉]

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PMCID: PMC8558963 PMID: 34737825

IF = 1.1

Methods

- Patients between ages of 3 and 10 years who had undergone T&A in 2005 and monitored until 2013

Results

Table 1 Differences in the number of diagnoses of pneumonia and admissions due to pneumonia between the tonsillectomy with adenoidectomy and control groups

		Control group (%)	T&A group (%)	Total (%)	*p*-value
Total		875 (83.3)	175 (16.7)	1,050 (100.0)	
Sex	Male	540 (61.7)	108 (61.7)	648 (61.7)	1
	Female	335 (38.3)	67 (38.3)	402 (38.3)	
Age at the performance of T&A	3–4 years old	60 (6.9)	12 (6.9)	72 (6.9)	1
	5–6 years old	290 (33.1)	58 (33.1)	348 (33.1)	
	7–8 years old	305 (34.9)	61 (34.9)	366 (34.9)	
	9–10 years old	220 (25.1)	44 (25.1)	264 (25.1)	
Level of income	1st quintile	60 (6.9)	12 (6.9)	72 (6.9)	1
	2nd quintile	110 (12.6)	22 (12.6)	132 (12.6)	
	3rd quintile	200 (22.9)	40 (22.9)	240 (22.9)	
	4th quintile	280 (32.0)	56 (32.0)	336 (32.0)	
	5th quintile	225 (25.7)	45 (25.7)	270 (25.7)	
Type of National Health Insurance	Employee	510 (58.3)	102 (58.3)	612 (58.3)	1
	Regional	365 (41.7)	73 (41.7)	438 (41.7)	
Residence	Seoul (capital)	145 (16.6)	29 (16.6)	174 (16.6)	1
	Metropolitan	245 (28.0)	49 (28.0)	294 (28.0)	
	City (small- and medium-sized)	445 (50.9)	89 (50.9)	534 (50.9)	
	County	40 (4.6)	8 (4.6)	48 (4.6)	
Diagnosis of pneumonia		134 (15.3)	39 (22.3)	173 (16.5)	0.023*
Admission due to pneumonia		19 (2.2)	7 (4.0)	26 (2.5)	0.155

Table 2 Hazard ratios for pneumonia in the Cox proportional hazards model with univariate and multivariate analysis

		Univariate analysis		Multivariate analysis	
		HR	95%CI	HR	95%CI
Sex	Male	1		1	
	Female	1.11	0.816–1.498	1.12	0.819–1.540
Age	Year	0.79*	0.728–0.864	0.80*	0.727–0.873
Level of income	1st quintile	1		1	
	2nd quintile	1.17	0.605–2.255	0.99	0.500–1.951
	3rd quintile	0.94	0.501–1.746	0.91	0.474–1.745
	4th quintile	0.79	0.427–1.451	0.81	0.432–1.531
	5th quintile	0.84	0.453–1.572	0.96	0.509–1.819
Type of National Health Insurance	Employee	1		1	
	Regional	0.82	0.602–1.114	0.90	0.652–1.245
Residence	Seoul (capital)	1		1	
	Metropolitan	1.05	0.667–1.638	1.14	0.718–1.793
	City (small- and medium- sized)	0.91	0.599–1.379	0.94	0.613–1.432
	County	0.84	0.368–1.908	1.03	0.427–2.480
T&A	Not performed	1		1	
	Performed	1.52*	1.062–2.167	1.53*	1.072–2.189

Discussion

- The tonsils are most immunologically active between the ages of 3 and 10 years
- Incompatible studies about effects of T&A on immunity
- Respiratory allergies such as allergic rhinitis and possibly consequent mouth breathing could affect a higher rate of pneumonia in the T&A group even after T&A
- Which factor contributed to pneumonia is unclear

Back to our patient

Age, Sex	**8y**, female
Height, Weight	130 cm / 30 kg
BMI	17.75 kg/㎡
PHx	Denied
oAHI	**≈ 36 events/hr**
O_2 nadir	**78%**
ASA	**II**
ICU stay	**nil**

兒童及青少年生長身體質量指數（BMI）建議值

衛福部 102 年 6 月 11 日公布

BMI=體重（公斤）/身高^2（公尺^2）

年紀	男性				女性			
	過輕	正常範圍	過重	肥胖	過輕	正常範圍	過重	肥胖
	BMI＜	BMI 介於	BMI≧	BMI≧	BMI＜	BMI 介於	BMI≧	BMI≧
0.0	11.5	11.5-14.8	14.8	15.8	11.5	11.5-14.7	14.7	15.5
0.5	15.2	15.2-18.9	18.9	19.9	14.6	14.6-18.6	18.6	19.6
1.0	14.8	14.8-18.3	18.3	19.2	14.2	14.2-17.9	17.9	19.0
1.5	14.2	14.2-17.5	17.5	18.5	13.7	13.7-17.2	17.2	18.2
2.0	14.2	14.2-17.4	17.4	18.3	13.7	13.7-17.2	17.2	18.1
2.5	13.9	13.9-17.2	17.2	18.0	13.6	13.6-17.0	17.0	17.9
3.0	13.7	13.7-17.0	17.0	17.8	13.5	13.5-16.9	16.9	17.8
3.5	13.6	13.6-16.8	16.8	17.7	13.3	13.3-16.8	16.8	17.8
4.0	13.4	13.4-16.7	16.7	17.6	13.2	13.2-16.8	16.8	17.9
4.5	13.3	13.3-16.7	16.7	17.6	13.1	13.1-16.9	16.9	18.0
5.0	13.3	13.3-16.7	16.7	17.7	13.1	13.1-17.0	17.0	18.1
5.5	13.4	13.4-16.7	16.7	18.0	13.1	13.1-17.0	17.0	18.3
6.0	13.5	13.5-16.9	16.9	18.5	13.1	13.1-17.2	17.2	18.8
6.5	13.6	13.6-17.3	17.3	19.2	13.2	13.2-17.5	17.5	19.2
7.0	13.8	13.8-17.9	17.9	20.3	13.4	13.4-17.7	17.7	19.6
7.5	14.0	14.0-18.6	18.6	21.2	13.7	13.7-18.0	18.0	20.3
8.0	14.1	14.1-19.0	19.0	21.6	13.8	13.8-18.4	18.4	20.7
8.5	14.2	14.2-19.3	19.3	22.0	13.9	13.9-18.8	18.8	21.0

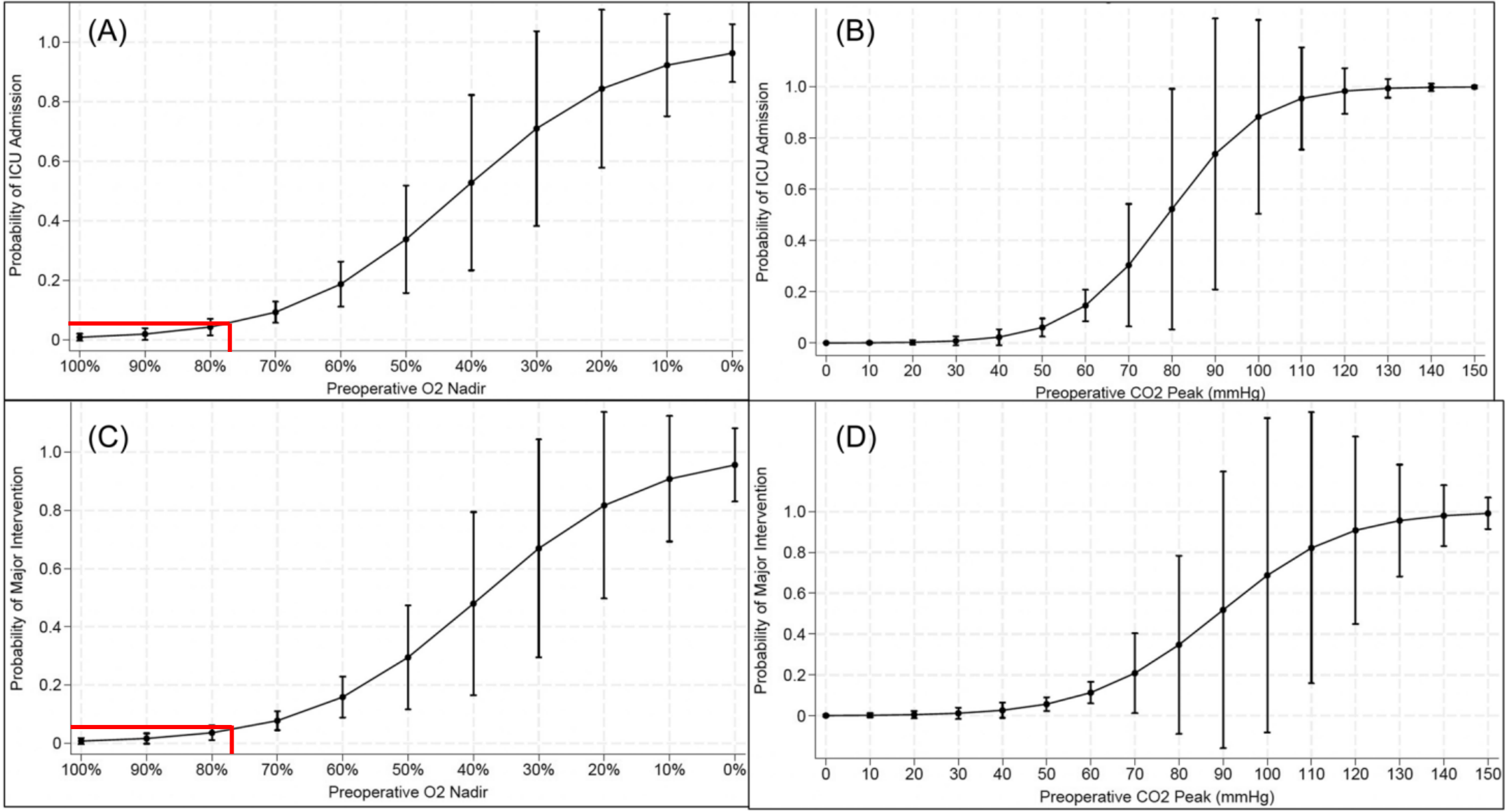

Figure 1. Logistical regression models for major interventions and ICU admission based on preoperative O_2 nadir and peak CO_2 with 95% confidence intervals. (A) Logistical regression model for probability of ICU admission based on preoperative O_2 nadir. (B) Logistical regression model for probability of ICU admission based on preoperative peak CO_2. (C) Logistical regression model for probability of major intervention based on preoperative O_2 nadir. (D) Logistical regression model for probability of major intervention based preoperative peak CO_2. ICU, intensive care unit.

Conclusion

Risk factors for complications of pediatric AT

	Major respiratory intervention	ICU admission	Prolonged admission (>48 h)
oAHI	✓ P = .003	✓ P = .004	✗ P = .21
O_2 nadir	✓ P < .001	✓ P < .001	✓ P < .001
Peak CO_2	✓ P = .003	✓ P < .001	✓ P = .02
BMI z score	✓ P < .001	✓ P = .03	✗ P = .64
Age	✗ P = .65	✓ P = .02	✓ P < .001

30-day postoperative complication

- Age < 3y had 4-fold increased risk of non-bleeding-related revisit
- ICU stay (OR = 36.97) increased risk of ER revisits
- ICU stay (OR = 73.89) and high ASA (OR = 3.24) increased risk of bleeding-related ER revisits
- **No** association between OSA severity and total revisit rate

Thanks for your attention!