Best strategies for confirming or ruling out asthma in patients referred from primary care

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COI (within 2 years)

- Funding
  - 한국연구재단
    - 미세먼지가 호흡기 질환의 질병 부담에 미치는 영향 (2022.12 종료)
    - 건강 빅데이터를 활용한 기관지확장증 질병 부담 연구(2023.02 종료)
  - 범부처
    - AirTom-RM을 이용한 호흡 모니터링의 유효성과 안전성을 평가하는 확증 임상시험(2022 종료)
  - 천식알레르기학회 연구비(2023-)

- 임상연구 – 무

- Lecture
  - 대원제약, 안국약품, 한림제약
  - 사노피

천식이 아닌데 천식이라고...

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- Over- and underdiagnosis of asthma
- Diagnostic criteria of asthma
- Diagnostic flow
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Table 2 Number of patients in each type of medical institution

Type of medical institutions	No. of medical institutions	No. of asthma patients (%)
Overall	16,804	831,613 (100.00)
Tertiary hospital	43	43,471 (5.23)
General hospital	280	83,194 (10.00)
Hospital	910	44,503 (5.35)
Convalescent hospital	379	2,933 (0.35)
Primary health clinic	14,745	686,063 (82.50)
Public health center	212	2,424 (0.29)
Branch office of public health center	222	532 (0.06)
County hospital	13	416 (0.05)

Choi, JTD 2017;9:3208-3214

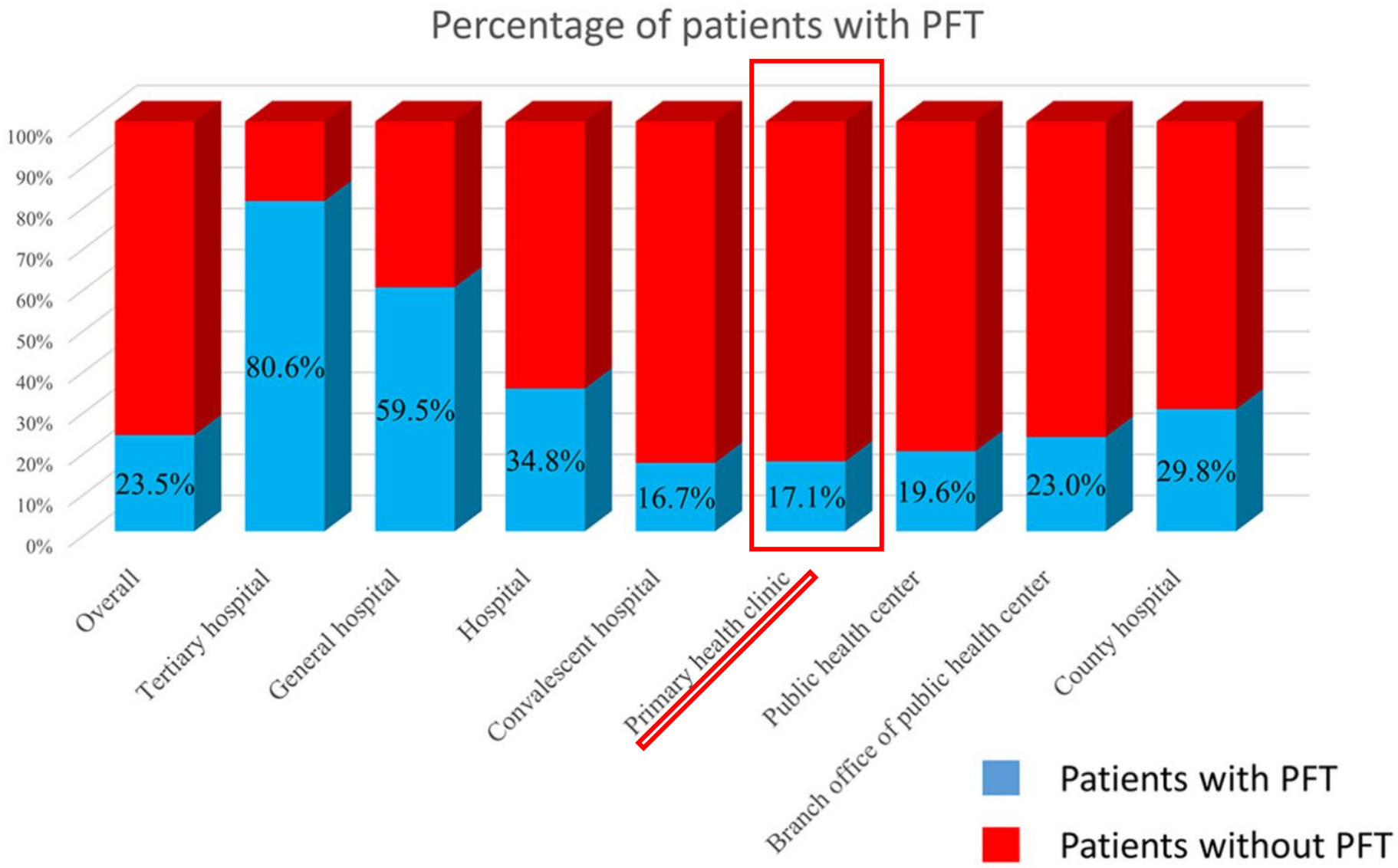


Figure 2 Rate of PFT in different types of medical institutions. PFT, pulmonary function test.

Choi, JTD 2017;9:3208-3214

Diagnostic accuracy of asthma diagnosed in primary care?

300 patients referred from primary care → spirometry with BDR

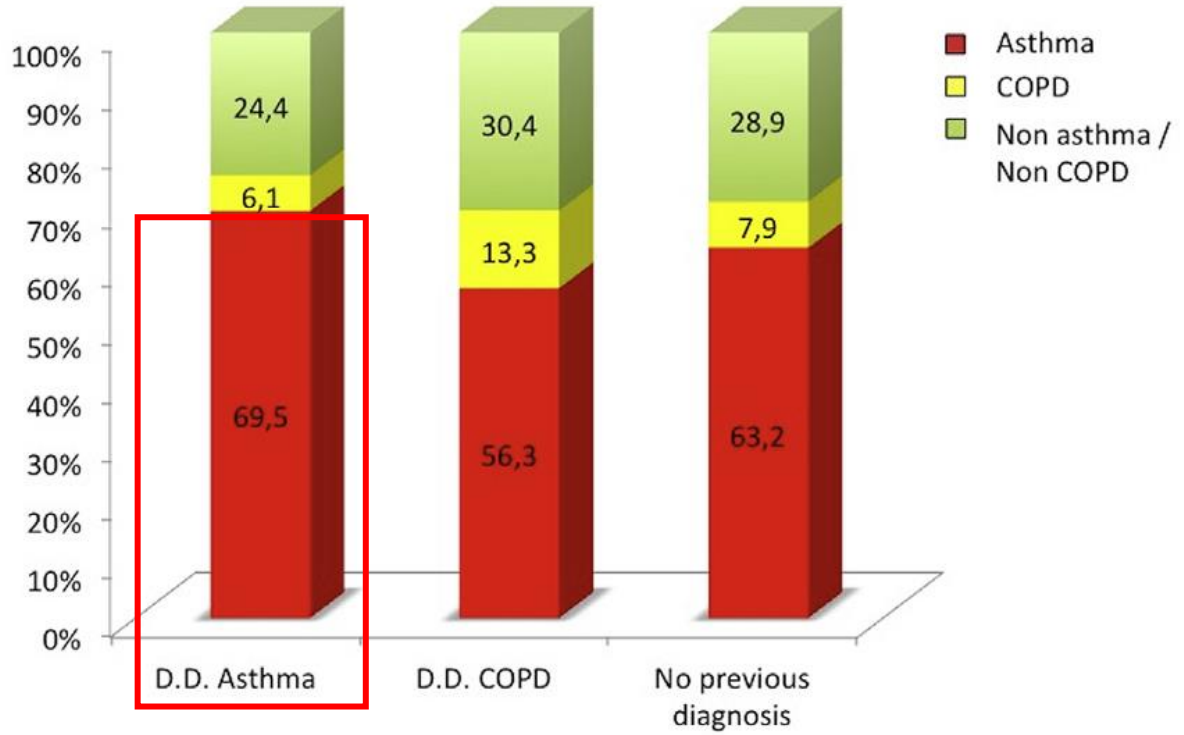
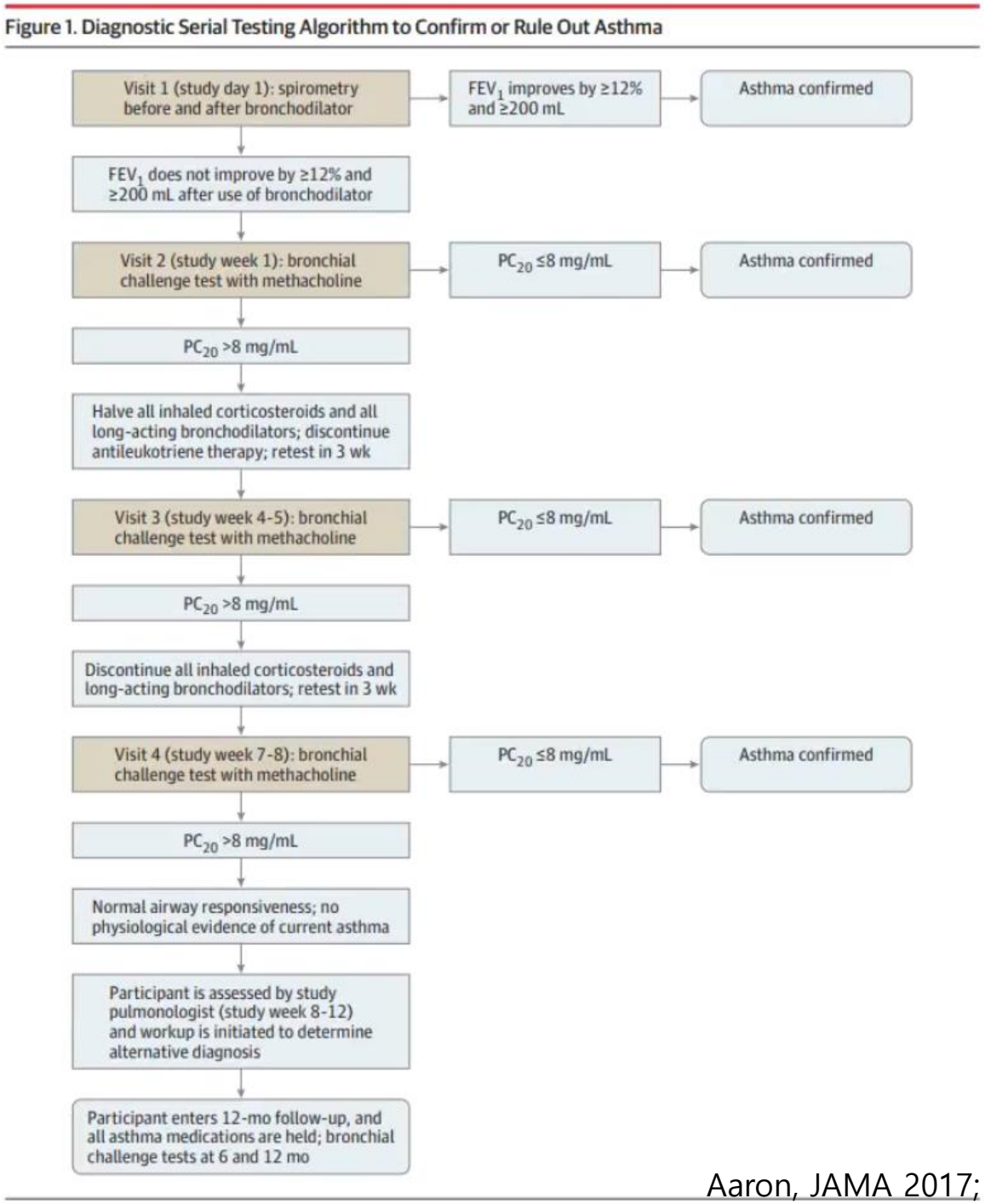


Fig. 2. "Concordant" and "non concordant" spirometric patterns in patients with doctor-diagnosis of asthma or COPD.

Heffler, Respiratory Medicine 142;2018:48-52

Overdiagnosis

Asthma was ruled out in 33%



Aaron, JAMA 2017; 317: 269–279.

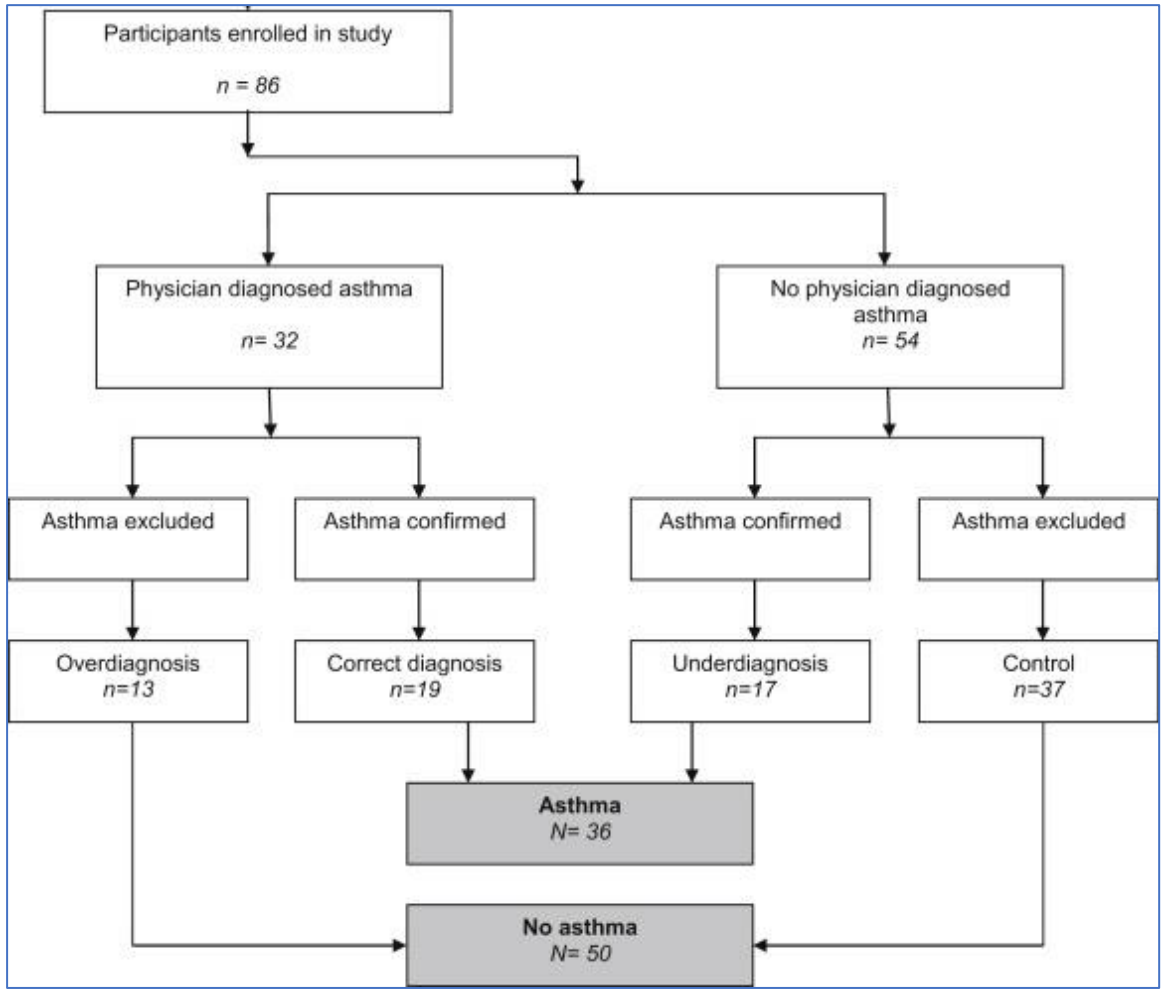
Misdiagnosis of asthma

Table 2. Study Pulmonologist's Diagnosis in Participants Who Had No Evidence of Airflow Obstruction, Bronchial Hyperreactivity, or Worsening of Asthma Symptoms After Having All Asthma Medications Tapered Off

Pulmonologist's Diagnosis	Participants, No. (%) (n = 213)
Asymptomatic	61 (28.6)
Allergic or nonallergic rhinitis	54 (25.3)
Asthma	28 (13.1)
GERD	18 (8.5)
Anxiety or hyperventilation	8 (3.8)
Obesity or deconditioning	7 (3.3)
Eosinophilic bronchitis	6 (2.8)
Ischemic heart disease	4 (1.9)
COPD	4 (1.9)
Chronic cough due to ACE inhibitors	4 (1.9)
Postviral cough	4 (1.9)
Bronchiectasis	2 (0.9)
Subglottic stenosis	2 (0.9)
Environmental chemical sensitivity	2 (0.5)
Interstitial lung disease	1 (0.5)
Kyphoscoliosis	1 (0.5)
Pulmonary hypertension	1 (0.5)
Costochondritis	1 (0.5)
Sarcoidosis	1 (0.5)
Vocal cord dysfunction	1 (0.5)
Tracheobronchomalacia	1 (0.5)
Recurrent viral bronchitis	1 (0.5)
Chronic cough of unknown etiology	1 (0.5)

Aaron, JAMA 2017; 317: 269–279.

Obese patients before biatric surgery



40% of patients with a prior diagnosis of asthma did not meet these criteria
31% of patients with no diagnosis of asthma had symptoms plus a positive test

Huisstede. Respir Med 2013;107:1356-1364

Potential harm of overdiagnosis

- Misdiagnosis of serious diseases
  - IHD, subglottic stenosis, pulmonary HTN, endobronchial tumor/TB
- Inappropriate OCS use → long-term use
- Significant opportunity cost (inappropriately spent)

Kavanagh. Breath 2019;15:e20-e27

Underdiagnosis

- **19-73% of individuals with respiratory symptoms**
  - Questionnaires sent to over 10,000 subjects in Copenhagen
  - 493 diagnosed with asthma (PFT)
    - 50% had not been diagnosed previously

- **Reasons for underdiagnosis**
  - Failing to recognize by physicians (m/i)
    - Attributing symptoms to obesity, deconditioning, cardiac disease, etc.

Kavanagh. Breath 2019;15:e20-e27

Potential harm of underdiagnosis

- Ongoing symptoms in patients
  - Leading to AE, OCS use, and hospitalization
- Rapid lung function decline → COPD-A

Kavanagh. Breath 2019;15:e20-e27

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Asthma diagnosis

1. Typical symptoms

2. Variable expiratory AFL

- 2-1. Documented expiratory AFL
- 2-2. Documented excessive variability in lung function

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1. Typical symptoms of asthma

Box 1-2. Diagnostic criteria for asthma in adults, adolescents, and children 6–11 years

1. HISTORY OF TYPICAL VARIABLE RESPIRATORY SYMPTOMS	
Feature	*Symptoms or features that support the diagnosis of asthma*
Wheeze, shortness of breath, chest tightness and cough (Descriptors may vary between cultures and by age)	• More than one type of respiratory symptom (in adults, isolated cough is seldom due to asthma) • Symptoms occur variably over time and vary in intensity • Symptoms are often worse at night or on waking • Symptoms are often triggered by exercise, laughter, allergens, cold air • Symptoms often appear or worsen with viral infections

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Expiratory AFL (1)

- FEV_1이 감소되어 있을 때 측정한 폐활량
- **FEV_1/FVC < LLN (< 0.75-0.80)**

Excessive variability (2)

Documented excessive variability in lung function	
BDR 양성	FEV_1 > 12% and > 200 mL after 200-400 mcg salbutamol (SABA 4시간, twice-daily LABA 24시간, once-daily LABA 36시간 이상 중단)
Positive challenge test	1. 상용량의 methacholine에서 FEV_1 > 20% 감소 2. 표준화된 과호흡, mannitol, hypertonic saline challenge시 FEV_1 >= 15% 감소 3. 운동 – FEV_1 > 10% 과 200 mL 감소
2주간 PEF의 과도한 변동	Average daily diumal PEF 변화량 > 10%
4주간 치료 후 폐기능 향상	1. FEV_1 > 12% and > 200 mL 2. PEF > 20%
병원 방문시마다 과도한 폐기능 변화	방문 시 FEV_1 > 12%와 > 200mL 변화 (**<u>호흡기 감염 제외</u>**)

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pre-bronchodilator test
mild restrictive pattern
FVC 70.9% (3.57L)
FEV1 67.7% (2.96L)
FEV1/FVC 82.76%

post-bronchodilator test
mild restrictive pattern
FVC 73.3% (3.69L)
FEV1 71.9% (3.14L)
FEV1/FVC 85.03%

Bronchodilator test : negative (180mL, 6.2%)

Pre-Bronchodilator test
Mild restrictive pattern
FVC 67.8% (3.46L)
FEV1 65.6% (2.86L)
FEV1/FVC 82.70%

Post-Bronchodilator test
Mild restrictive pattern
FVC 68.0% (3.47L)
FEV1 66.3% (2.89L)
FEV1/FVC 83.43%

Bronchodilator test : negative (30mL, 1.1%)

pre-bronchodilator test
mild restrictive pattern
FVC 71.6% (3.61L)
FEV1 70.9% (3.09L)
FEV1/FVC 85.70%

post-bronchodilator test
mild restrictive pattern
FVC 70.9% (3.57L)
FEV1 71.4% (3.11L)
FEV1/FVC 87.21%

Bronchodilator test : negative (20mL, 0.7%)

Pre-Bronchodilator test
Mild restrictive pattern
FVC 69.5% (3.58L)
FEV1 68.0% (2.96L)
FEV1/FVC 82.72%

Post-Bronchodilator test
Mild restrictive pattern
FVC 67.7% (3.49L)
FEV1 68.5% (2.98L)
FEV1/FVC 85.56%

Bronchodilator test : Negative (20mL, 0.8%)

Pre-Bronchodilator test
Mild restrictive pattern
FVC 73.6% (3.76L)
FEV1 71.6% (3.16L)
FEV1/FVC 83.91%

Post-Bronchodilator test
Mild restrictive pattern
FVC 74.9% (3.83L)
FEV1 75.0% (3.31L)
FEV1/FVC 86.42%

Bronchodilator test : negative (150mL, 4.8%)

Pre-Bronchodilator test
mild restrictive pattern
FVC 71.5%(3.71L)
FEV1 71.5%(3.13L)
FEV1/FVC 84.39%

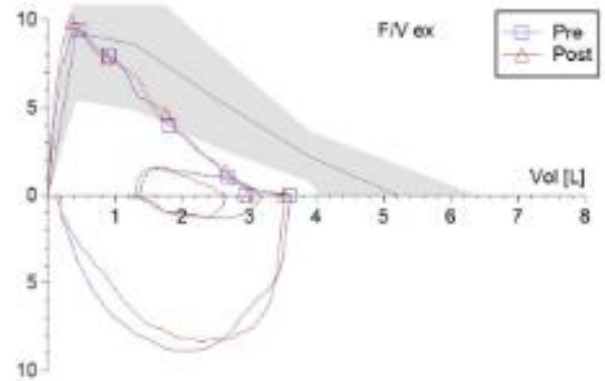
Post-Bronchodilator test
mild restrictive pattern
FVC 72.6%(3.77L)
FEV1 73.5%(3.22L)
FEV1/FVC 85.54%

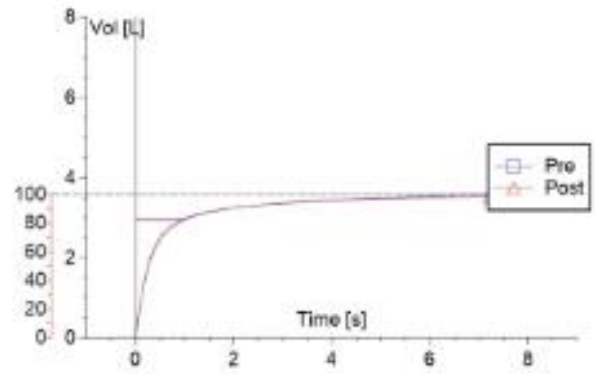
Bronchodilator test : Negative (90mL, 2.9%)

Provocholine provocation test: negative
PC20= could not be calculated

Race:	Asian	Height:	174.0 cm	Weight:	83.0 kg
BSA:	1.98 m²	Pred. Module:	V-Dr.Choi+standar..	Technician:	Doh HR

	Pred	Pre Meas	Pre%Ref	Post Meas	Post %Ref	Post % Chg
FVC	5.19	3.58	69.1	3.52	67.8	-1.9
FEV 1	4.31	2.94	68.1	2.97	68.9	1.1
FEV1%FVC	86	82	95.6	84	98.5	3.0
FEV1%VCmax	86	82	95.6	84	98.5	3.0
FEF25-75%	4.34	3.16	72.8	3.55	81.7	12.3
PEF	9.27	9.44	101.7	9.91	106.9	5.1
MEF75	8.57	7.97	93.0	7.81	91.1	-2.0
MEF50	5.23	4.01	76.7	4.66	89.1	16.1
MEF25	2.20	1.01	45.7	1.40	63.6	39.1
MMEF	4.34	3.16	72.8	3.55	81.7	12.3
FIVC	5.19	3.43	66.1	3.43	66.0	-0.2
FIV1				3.41		
VT	0.59					
ERV	1.69					
VC MAX_sp	5.19	3.58	69.1	3.52	67.8	-1.9
IC	3.38					
BF MVV		44.20				
MVV	172	102	59.5			
PIF		8.89		8.34		-6.3
FETPEF		0.05		0.04		-26.2





Comment

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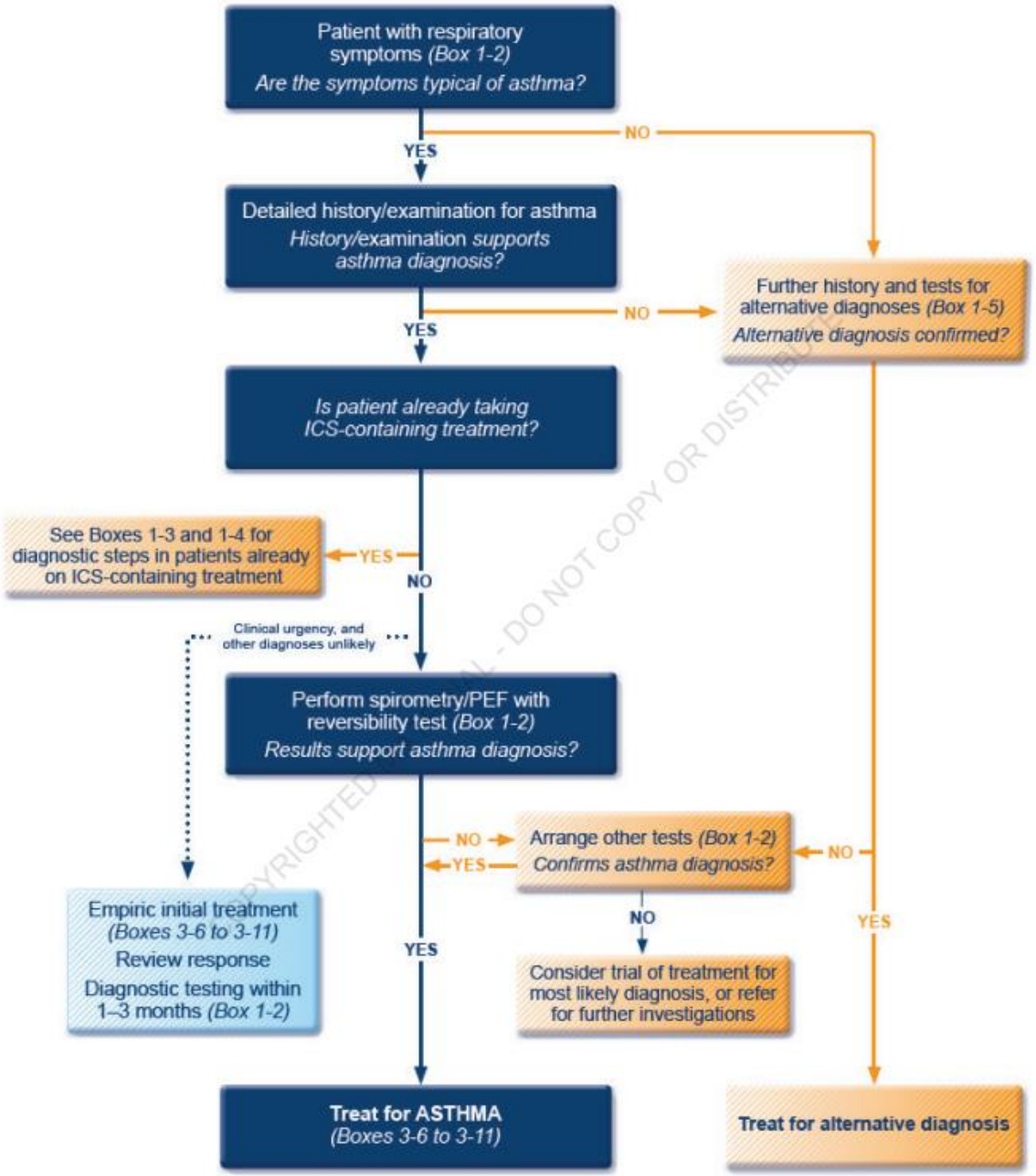
Box 1-1. Diagnostic flowchart for clinical practice



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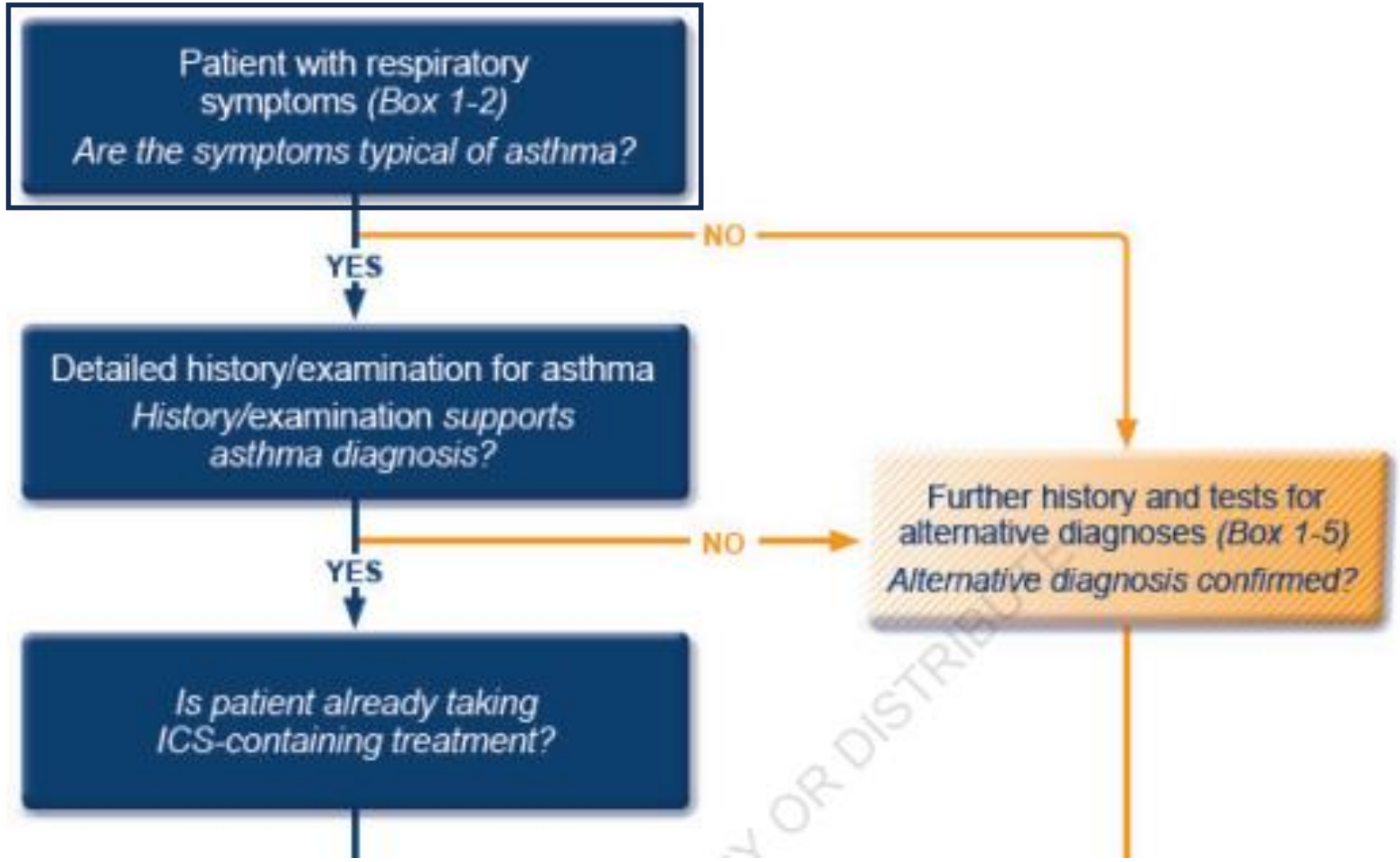
Box 1-1. Diagnostic flowchart for clinical practice



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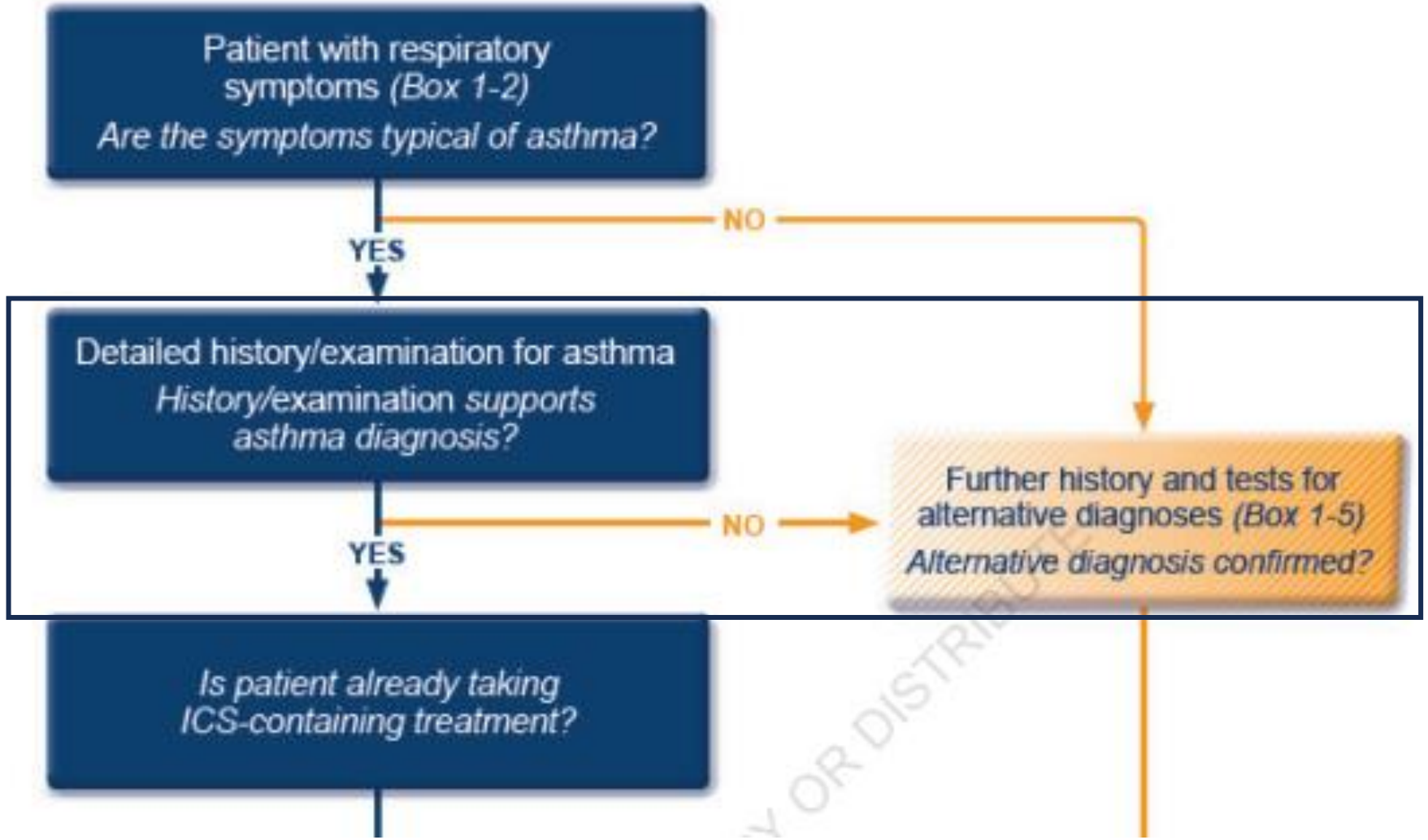
Box 1-1. Diagnostic flowchart for clinical practice



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Box 1-5 (continued). Differential diagnosis of asthma in adults, adolescents and children 6–11 years

Age	Symptoms	Condition
12–39 years	Sneezing, itching, blocked nose, throat-clearing	Chronic upper airway cough syndrome
	Dyspnea, inspiratory wheezing (stridor)	Inducible laryngeal obstruction
	Dizziness, paresthesia, sighing	Hyperventilation, dysfunctional breathing
	Productive cough, recurrent infections	Bronchiectasis
	Excessive cough and mucus production	Cystic fibrosis
	Cardiac murmurs	Congenital heart disease
	Shortness of breath, family history of early emphysema	$Alpha_1$-antitrypsin deficiency
	Sudden onset of symptoms	Inhaled foreign body
40+ years	Dyspnea, inspiratory wheezing (stridor)	Inducible laryngeal obstruction
	Dizziness, paresthesia, sighing	Hyperventilation, dysfunctional breathing
	Cough, sputum, dyspnea on exertion, smoking or noxious exposure	COPD*
	Productive cough, recurrent infections	Bronchiectasis
	Dyspnea with exertion, nocturnal symptoms, ankle edema	Cardiac failure
	Treatment with angiotensin converting enzyme (ACE) inhibitor	Medication-related cough
	Dyspnea with exertion, non-productive cough, finger clubbing	Parenchymal lung disease
	Sudden onset of dyspnea, chest pain	Pulmonary embolism
	Dyspnea, unresponsive to bronchodilators	Central airway obstruction
All ages	Chronic cough, hemoptysis, dyspnea; and/or fatigue, fever, (night) sweats, anorexia, weight loss	Tuberculosis

*For more detail, see Chapter 5 (p.141). Any of the above conditions may also contribute to respiratory symptoms in patients with confirmed asthma.

-History taking

- CBC
- BNP
- d-Dimer
- CXR/CT
- PNS series

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Differential diagnosis

- Wrong diagnosis in 12-50% of subjects assumed to have severe asthma

Symptoms	Differential diagnosis
Dyspnea	**Obesity, COPD**, Cardiac disease, deconditioning
Cough	VCD, UACS, GERD, **bronchiectasis**, ACEi
Wheeze	**Obesity, COPD**, Tracheobronchomalacia, VCD

Hashimoto et al., Clin Exp Allergy 2012;42:693-705.
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Case

- 57/남자

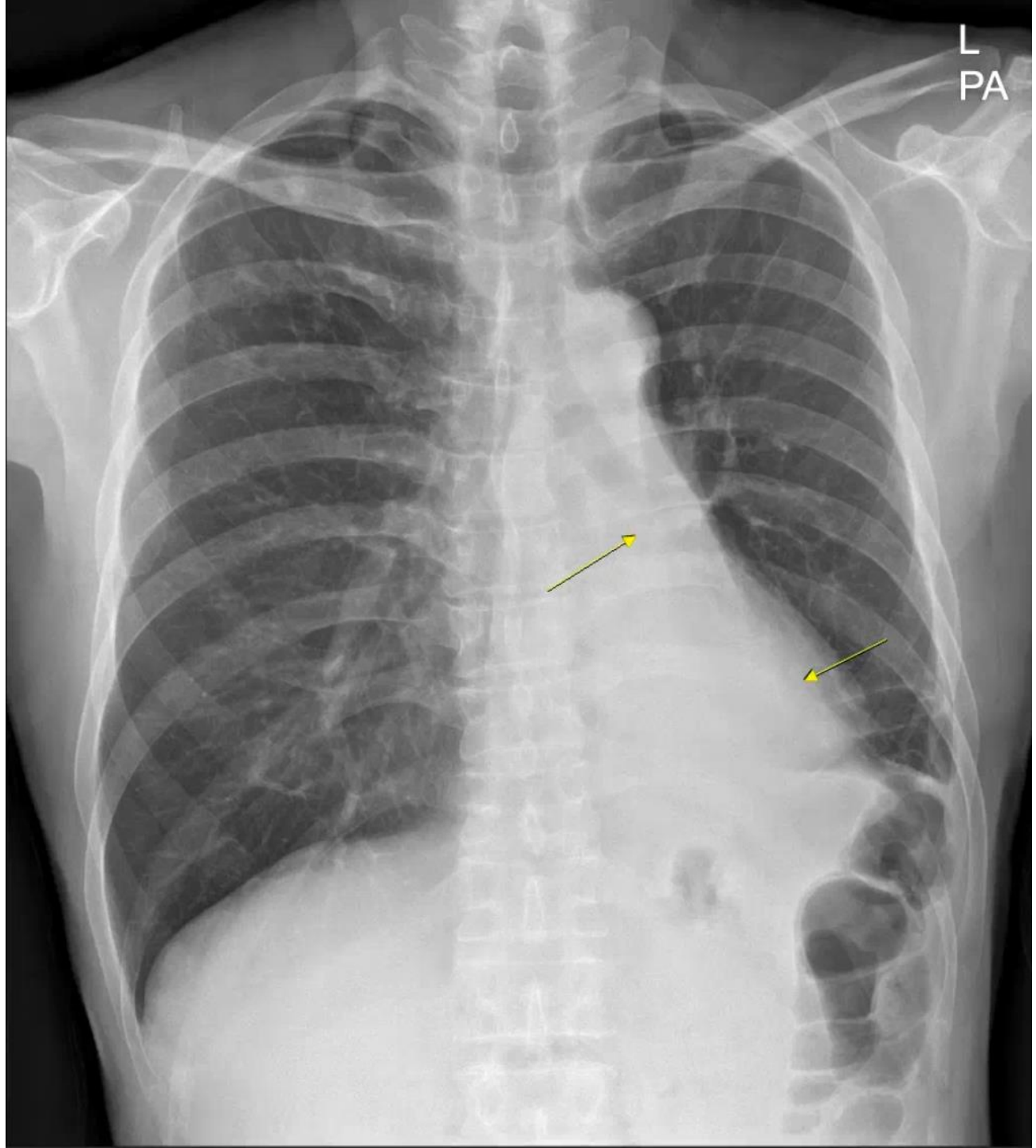
- 개인력: Current-smoker (30PY)
- 과거력: AD(-) AR(-) 천식(-) 결핵(-)

- 3개월 전부터 쌕쌕거리고 약간 숨이 차서 동네 의원 내원

- 고용량 ICS/LABA → Triple 치료에도 호전 없어 전원

표 3-7. 한국어판 천식조절검사(Asthma control test: ACT)

1	2	3	4	5
지난 4 주 동안, 당신은 천식으로 인해 얼마나 많은 시간을 직장이나 학교나 집에서 평소에 했던 만큼 일하고 공부하고 활동하는데 지장을 받았습니까?				
항상 그랬다	**대부분의 시간 동안 그랬다**	다소의 시간 동안 그랬다	아주 약간의 시간 동안 그랬다	전혀 그렇지 않았다
지난 4 주 동안, 당신은 얼마나 자주 숨을 헐떡였거나 / 숨을 쉬기가 어려웠습니까?				
하루에 두번 이상 그랬다	**하루에 한번 그랬다**	일주일에 3-6번 그랬다	일주일에 1-2번 그랬다	전혀 그렇지 않았다
지난 4 주 동안, 당신은 천식증상(쌕쌕거리는 소리, 기침, 숨가쁨, 가슴답답함이나 통증) 으로 인해 얼마나 자주 밤에 잠을 깨거나 아침에 평소보다 일찍 일어났습니까 ?				
일주일에 4일 밤 이상을 그랬다	**일주일에 2-3일 밤을 그랬다**	일주일에 한번 그랬다	한 두번 그랬다	전혀 그렇지 않았다
지난 4주 동안, 당신은 응급약물(예를 들면 살부타몰, 페노테롤, 벤토린®, 베로텍® 등)을 얼마나 자주 사용했습니까 ?				
하루에 3번 이상 사용했다	하루에 1-2번 사용했다	일주일에 2-3번 사용했다	일주일에 한 번 이하로 사용했다	**전혀 사용하지 않았다**
당신은 지난 4주 동안 천식을 얼마나 잘 조절했다고 평가하겠습니까?				
전혀 조절하지 못했다	잘 조절하지 못했다	다소 조절했다	잘 조절했다	완벽하게 조절했다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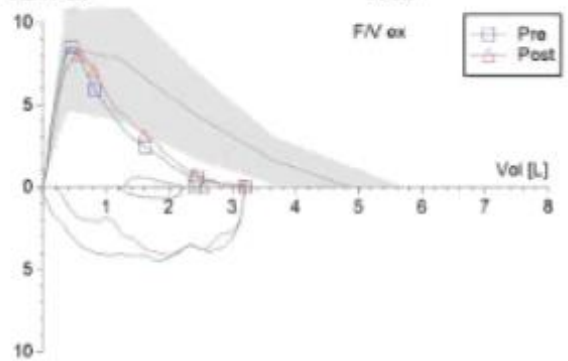
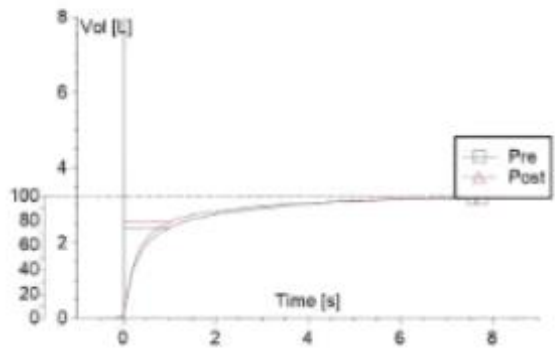
PA

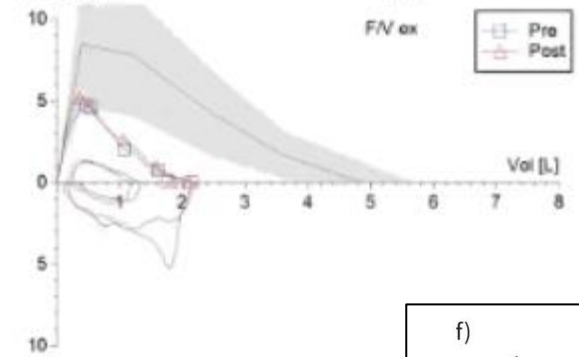
	Pred	Pre Meas	Pre%Ref	Post Meas	Post %Ref	Post % Chg
FVC	4.85	3.19	65.8	3.19	65.9	0.0
FEV 1	3.79	2.40	63.3	2.54	67.0	5.9
FEV1%FVC	75	75	99.6	80	105.4	5.9
FEV1%VCmax	75	74	97.8	80	105.4	7.8
FEF25-75%	3.19	1.79	56.2	2.33	73.3	30.5
PEF	8.46	8.54	101.0	8.02	94.9	-6.1
MEF75	7.75	5.91	76.3	7.06	91.1	19.3
MEF50	4.34	2.43	55.9	3.14	72.2	29.1
MEF25	1.63	0.57	34.7	0.74	45.5	31.1
MMEF	3.19	1.69	53.1	2.33	73.3	37.9
FIVC	4.85	3.25	67.0	2.97	61.2	-8.7
FIV1		3.21		2.87		-10.8
VT	0.46					
ERV	1.53					
VC MAX_sp	4.85	3.25	67.0	3.19	65.9	-1.8
IC	3.06					
BF MVV		38.17				
MVV	140	67	47.5			
PIF		4.46		4.13		-7.4
FETPEF		0.05		0.07		34.9





Comment

PIF	2.91
FETPEF	0.10



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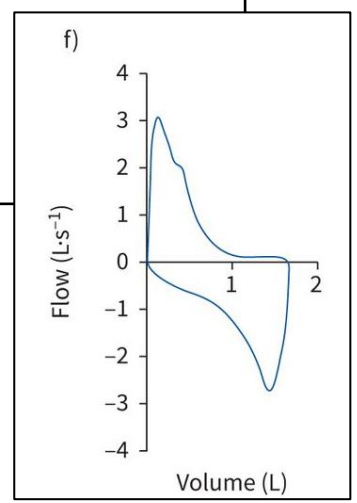


Unilateral mainstem bronchial obstruction

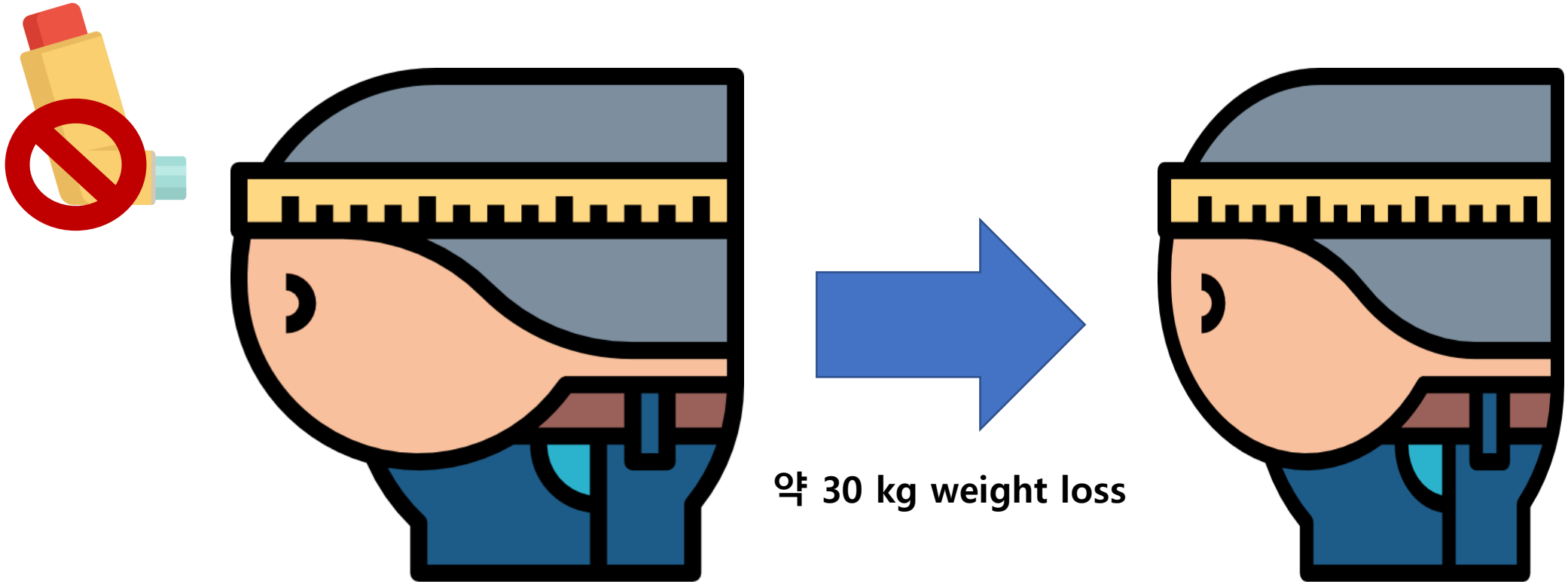
Case

- 42세/M
- 170cm/120kg
- 2014년 호흡곤란으로 내원 당시 신체검진 상 wheezing (+)
- Never smoker, Allergy (-) Pulm TB (-)

- CXR/Chest CT - Normal
- PFT: Post-BD FEV_1/FVC 0.76, Post-BD FEV_1 75%pred
- BDR (-) MBPT test (-)
- FENO 20, Blood eos – 100

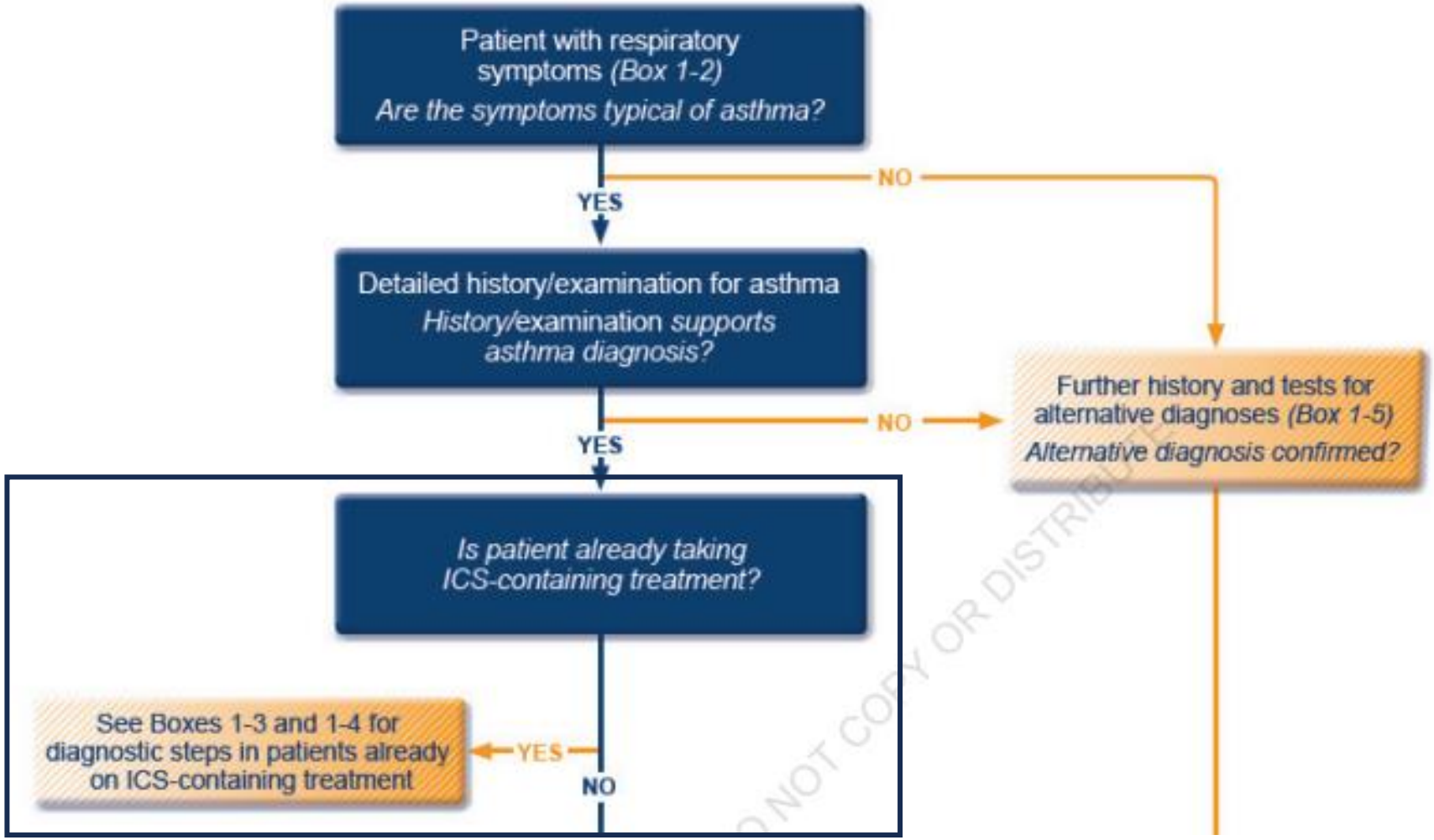
- High-dose ICS/LABA 추적관찰 → f/u loss

3년 후(2017년) pre-op risk assessment로 내원



"저 천식이 아니었던 것 같아요!"

Box 1-1. Diagnostic flowchart for clinical practice



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Box 1-3. Steps for confirming the diagnosis of asthma in a patient already taking ICS-containing treatment

Current status	Steps to confirm the diagnosis of asthma
Variable respiratory symptoms and variable airflow limitation	Diagnosis of asthma is confirmed. Assess the level of asthma control (Box 2-2, p.38) and review ICS-containing treatment (Box 3-12, p.65, Box 3-13, p.66).
Variable respiratory symptoms but no variable airflow limitation	Consider repeating spirometry after withholding bronchodilator (4 hrs for SABA, 24 hrs for twice-daily ICS-LABA, 36 hrs for once-daily ICS-LABA) or during symptoms. Check between-visit variability of FEV_1, and bronchodilator responsiveness. If still normal, consider other diagnoses (Box 1-5, p.30). *If FEV_1 is >70% predicted*: consider stepping down ICS-containing treatment (see Box 1-5) and reassess in 2–4 weeks, then consider bronchial provocation test or repeating bronchodilator responsiveness. *If FEV_1 is <70% predicted*: consider stepping up ICS-containing treatment for 3 months (Box 3-12, p.65), then reassess symptoms and lung function. If no response, resume previous treatment and refer patient for diagnosis and investigation.
Few respiratory symptoms, normal lung function, and no variable airflow limitation	Consider repeating BD responsiveness test again after withholding bronchodilator as above or during symptoms. If normal, consider alternative diagnoses (Box 1-5, p.30). Consider stepping down ICS-containing treatment (see Box 1-5): • *If symptoms emerge and lung function falls*: asthma is confirmed. Step up ICS-containing treatment to previous lowest effective dose. • *If no change in symptoms or lung function at lowest controller step*: consider ceasing ICS-containing, and monitor patient closely for at least 12 months (Box 3-16).
Persistent shortness of breath and persistent airflow limitation	Consider stepping up ICS-containing treatment for 3 months (Box 3-12, p.65), then reassess symptoms and lung function. If no response, resume previous treatment and refer patient for diagnosis and investigation. Consider asthma–COPD overlap (Chapter 5, p.159).

'Variable airflow limitation' refers to expiratory airflow. See list of abbreviations (p.10).

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On ICS-containing treatment

Sx	AFL	Approach
O	(O) Variable	천식 진단
O	X	**1. 흡입기 중단 후 BDR test (SABA 4시간, LABA (24-36시간))** **2. FEV_1 < 70% → step-up (3개월) → lung function** **3. FEV_1 > 70% → step-down (2-4주) → PT/BDR test**
Few	X	1. 흡입기 중단 → BDR 2. Step-down → Reassess (증상과 lung function)
O	(O) Persistent	1. Step-up 3개월 → Reassess (증상과 lung function) (e.g. SA, ACO)

Variable respiratory symptoms but no variable airflow limitation	Consider repeating spirometry after withholding bronchodilator (4 hrs for SABA, 24 hrs for twice-daily ICS-LABA, 36 hrs for once-daily ICS-LABA) or during symptoms. Check between-visit variability of FEV_1, and bronchodilator responsiveness. If still normal, consider other diagnoses (Box 1-5, p.30). *If FEV_1 is >70% predicted*: consider stepping down ICS-containing treatment (see Box 1-5) and reassess in 2–4 weeks, then consider bronchial provocation test or repeating bronchodilator responsiveness. *If FEV_1 is <70% predicted*: consider stepping up ICS-containing treatment for 3 months (Box 3-12, p.65), then reassess symptoms and lung function. If no response, resume previous treatment and refer patient for diagnosis and investigation.

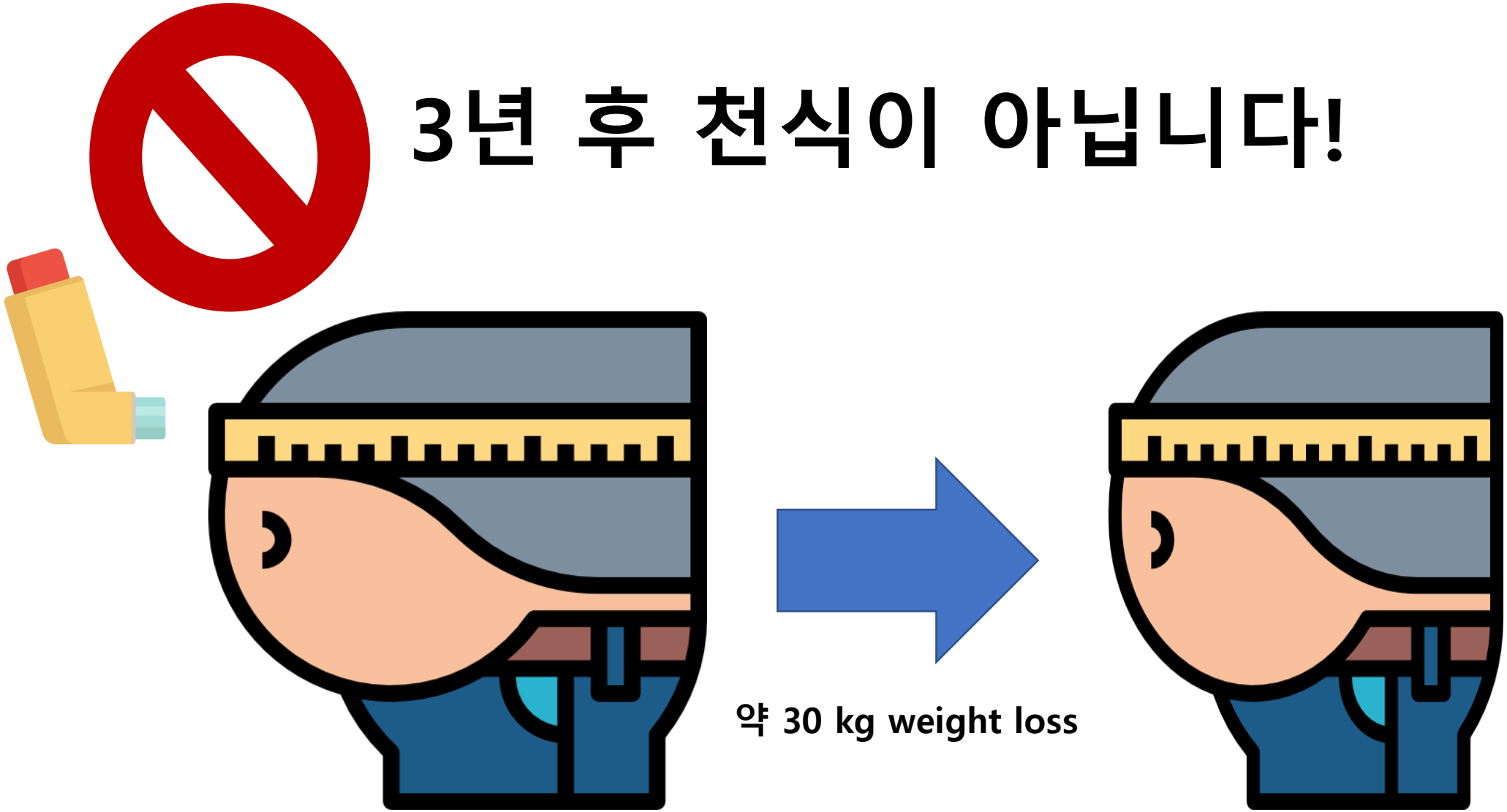
Case

- 42세/M
- 170cm/120kg
- 2014년 호흡곤란으로 내원 당시 신체검진 상 wheezing (+)
- Never smoker, Allergy (-) Pulm TB (-)

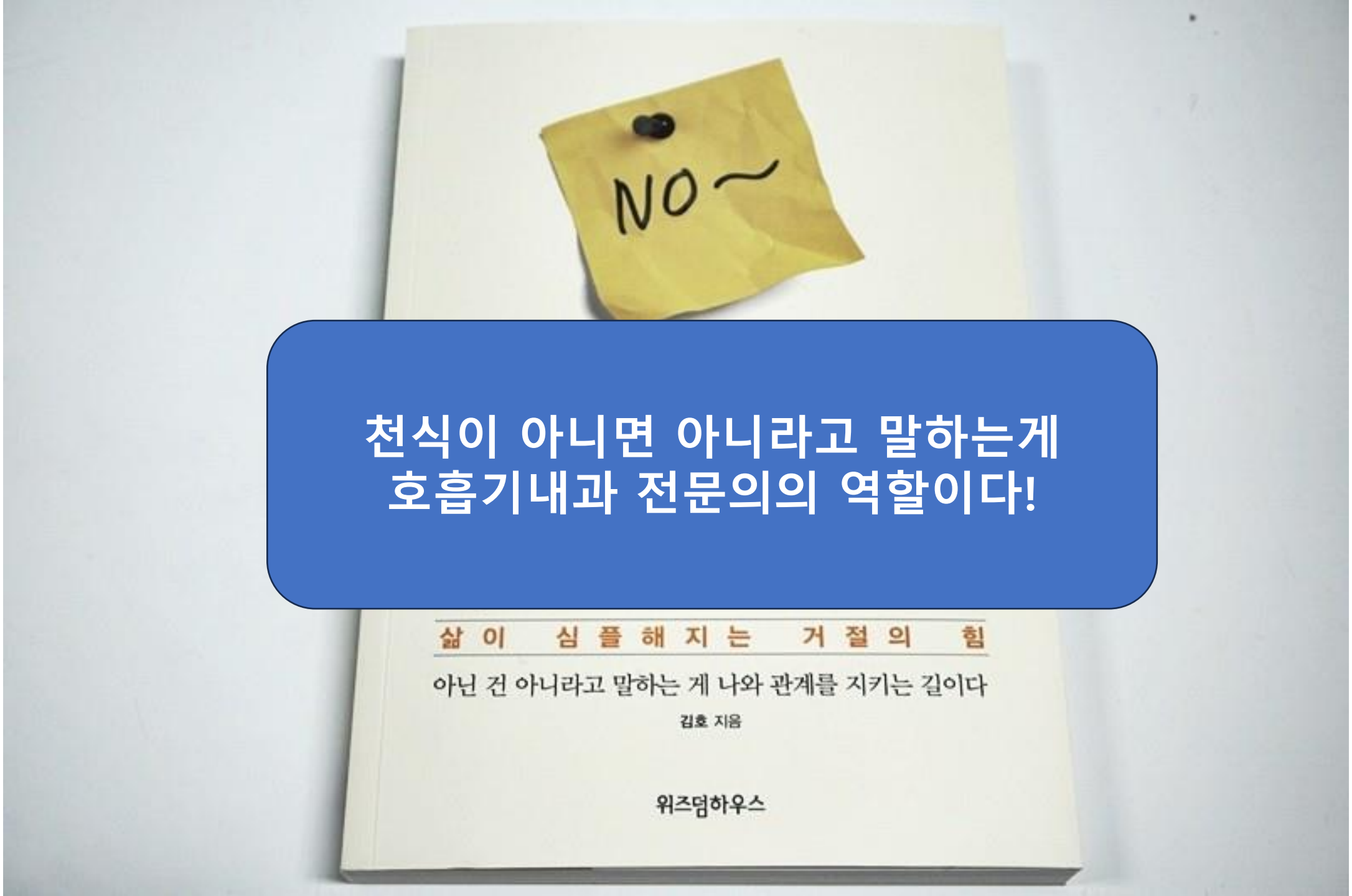
- CXR/Chest CT - Normal
- **PFT – Post-BD FEV_1/FVC 0.76, Post-BD FEV1 75%pred**
- BDR (-) MBPT test (-)
- FENO 20, Blood eos – 100

- High-dose ICS/LABA 추적관찰 → f/u loss

3년 후 천식이 아닙니다!



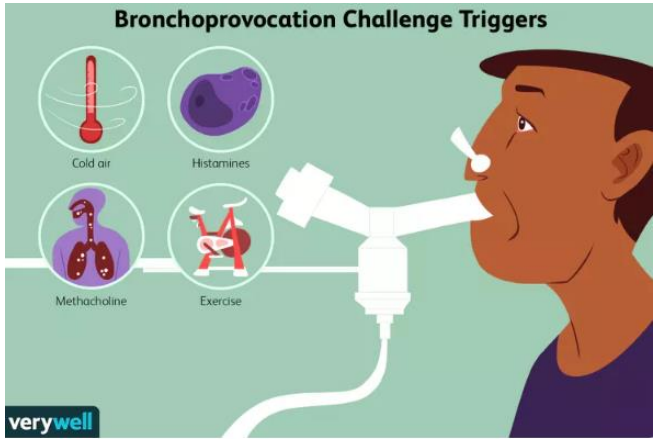
"저 천식이 아니었던 것 같아요!"



천식이 아니면 아니라고 말하는게
호흡기내과 전문의의 역할이다!

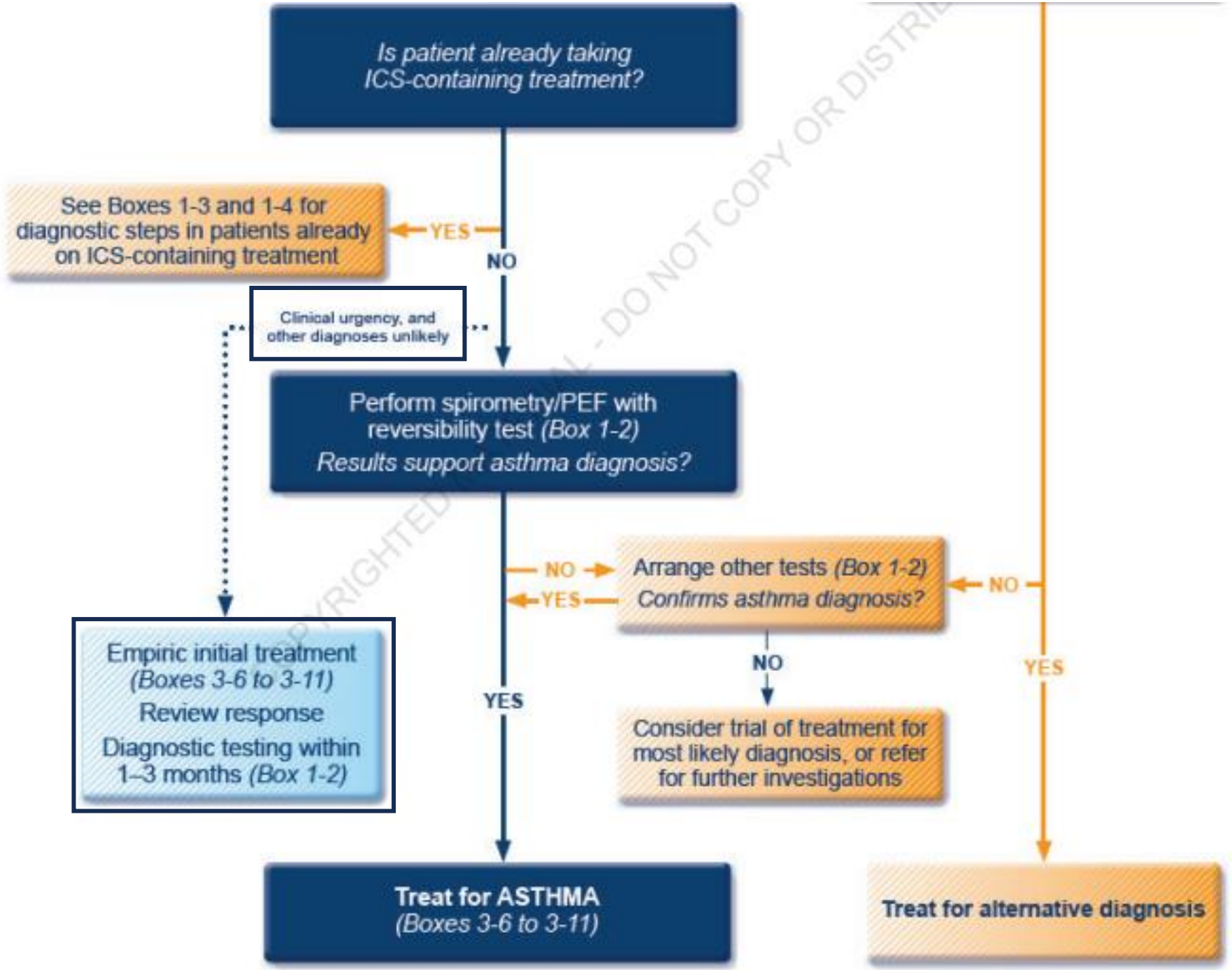
어떻게 해야 했을까?

FEV1이 정상에 가까우므로
ICS/LABA Step-down



BDR, provocation test

중단을 고려


Is patient already taking ICS-containing treatment?
YES
See Boxes 1-3 and 1-4 for diagnostic steps in patients already on ICS-containing treatment
NO
Clinical urgency, and other diagnoses unlikely
Perform spirometry/PEF with reversibility test (Box 1-2)
Results support asthma diagnosis?
NO
YES
Arrange other tests (Box 1-2)
Confirms asthma diagnosis?
NO
NO
YES
Empiric initial treatment (Boxes 3-6 to 3-11)
Review response
Diagnostic testing within 1–3 months (Box 1-2)
YES
Consider trial of treatment for most likely diagnosis, or refer for further investigations
Treat for ASTHMA (Boxes 3-6 to 3-11)
Treat for alternative diagnosis

GINA 2023

2022. 12. 11 EM

■ 내원경로

직접내원

■ 주호소

* 주증상 숨이 가쁘다

발생일시 : 2022-12-07 23시 53분

■ 현병력

기침을 하면 호흡하기 힘들다고 호소함.

3개월 전부터 마른기침 발생
1개월 전부터 마른기침 심해지며 기침 몰아서 하며 기침 후 호흡곤란 시작됨
기침할 시 가슴 통증 동반된다고 함

상기증상으로 local 병원 여러 곳 방문하여 CXR 검사 후 이상 없다고 들었다고 하며
약 처방 받아 복용하였지만 증상 호전되지 않았고 금일 증상 심하여 내원함

Ex-smoker: 20갑년(1개월 전 증상 심해졌을 때부터 금연)

P/E)
LS: wheezing(+), both

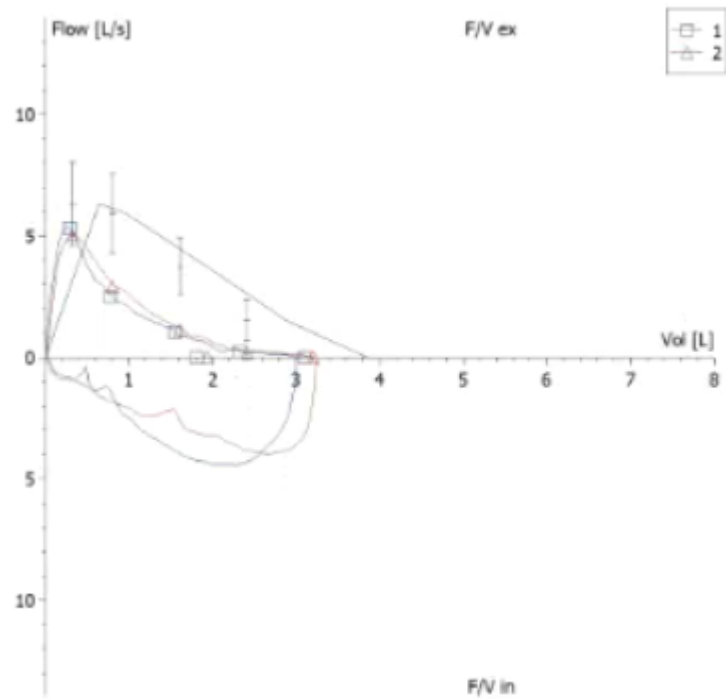
기저질환 없는 분
10년 전 갑상선 암으로 갑상선 절제술

	[퇴원 먹는약]				
13	[처음] COUGH SYRUP 20ml/P (유한)	1	PKG	3회	3P
	※ [차광]				
14	[처음] MUCOSTA TAB 100mg (오츠카)	1	T	3회	3P
	※ [차광][유사외관]				
15	[처음] LEVOTUSS TAB 60mg (현대)	1	T	3회	3P
	※ [유사발음]				
	[기타]				
16	[처음] ventolin EVOHALER 20mg/B (GSK)	1	BTL	1회	NB
	※ [차광] 호흡곤란시 사용하세요				

2. Variable expiratory AFL (2)

Documented excessive variability in lung function	
BDR 양성	FEV_1 > 12% and > 200 mL after 200-400 mcg salbutamol (SABA 4시간, twice-daily LABA 24시간, once-daily LABA 36시간 이상 중단)
2주간 PEF의 과도한 변동	Average daily diumal PEF 변화량 > 10%
4주간 치료 후 폐기능 향상	1. FEV_1 > 12% and > 200 mL 2. PEF > 20%
Positive challenge test	1. 상용량의 methacholine에서 FEV_1 > 20% 감소 2. 표준화된 과호흡, mannitol, hypertonic saline challenge시 $FEV_1 \geq 15\%$ 감소 3. 운동 – FEV_1 > 10% 과 200 mL 감소
병원 방문시마다 과도한 폐기능 변화	방문 시 FEV_1 > 12%와 > 200mL 변화 (**<u>호흡기 감염 제외</u>**)

		Pred	Act1	%(A1/P	Act2	%(A2/P	D%(A2/
FVC	[L]	3.84	3.09	80.6	3.19	83.2	3.2
FEV 1	[L]	3.14	1.80	57.4	1.93	61.5	7.2
FEV 1 % FVC	[%]	82.07	58.31	71.0	60.52	73.7	3.8
FEV 1 % VC MAX	[%]	82.07	58.31	71.0	60.28	73.4	3.4
PEF	[L/s]	6.32	5.31	84.1	5.02	79.3	-5.6
MEF 75	[L/s]	5.92	2.46	41.6	2.91	49.2	18.3
MEF 50	[L/s]	3.75	1.02	27.3	1.12	30.0	9.8
MEF 25	[L/s]	1.51	0.23	15.4	0.16	10.7	-30.5
MMEF 75/25	[L/s]	3.11	0.64	20.6	0.69	22.2	7.7
FVC IN	[L]	3.84	2.96	77.1	3.21	83.6	8.3
FIV1	[L]		2.57		2.72		5.9
VT	[L]	0.50					
ERV	[L]						
VC MAX	[L]	3.84	3.09	80.6	3.21	83.6	3.7
IC	[L]	2.40					
MV	[L/min]	10.00					
MVV	[L/min]	101.5	46.51	45.8			
PIF	[L/s]		4.48		4.00		-10.8
FET PEF	[s]		0.05		0.06		21.1



3주 후

		Pred	Act1	%(A1/P	Act2	%(A2/P	D%(A2/
FVC	[L]	3.85	3.40	88.4	3.34	86.9	-1.7
FEV 1	[L]	3.14	2.77	88.1	2.68	85.4	-3.0
FEV 1 % FVC	[%]	82.07	81.42	99.2	80.29	97.8	-1.4
FEV 1 % VC MAX	[%]	82.07	81.42	99.2	76.47	93.2	-6.1
PEF	[L/s]	6.32	6.76	106.9	6.12	96.8	-9.5
MEF 75	[L/s]	5.92	6.09	102.9	6.07	102.7	-0.2
MEF 50	[L/s]	3.75	3.55	94.6	3.02	80.5	-14.9
MEF 25	[L/s]	1.51	1.05	69.7	0.70	46.4	-33.5
MMEF 75/25	[L/s]	3.11	2.85	91.7	2.24	72.0	-21.4
FVC IN	[L]	3.85	3.30	85.9	3.51	91.3	6.2
FIV1	[L]		3.15		3.42		8.4
VT	[L]	0.51					
ERV	[L]						
VC MAX	[L]	3.85	3.40	88.4	3.51	91.3	3.2
IC	[L]	2.40					
MV	[L/min]	10.14					
MVV	[L/min]	102.2	82.45	80.7			
PIF	[L/s]		5.78		6.10		5.6
FET PEF	[s]		0.08		0.13		57.9

		Pred	Act1	%(A1/P	Act2	%(A2/P	D%(A2/
FVC	[L]	3.84	3.09	80.6	3.19	83.2	3.2
FEV 1	[L]	3.14	1.80	57.4	1.93	61.5	7.2
FEV 1 % FVC	[%]	82.07	58.31	71.0	60.52	73.7	3.8

Delta FEV1 → 2.68 – 1.93 = 0.75 L > 200 mL
(0.75 / 1.93) x 100 = 38.9%

의무기록에 진단 criteria 정리

■ 진단명

Asthma

Nonatopic eosinophilic asthma
어렸을 때 URI시 wheeze/호흡곤란
사춘기 이후 증상 무
2022.12 호흡곤란으로 응급실 내원
BDR 음성, MBPT 시행안함
Excessive variability between visits (+)
Blood Eos 1105(12.7%), Sputum Eos 17.65, FeNO 61
알레르기비염(-) 아토피(-) Total IgE 28.3, MAST - 시행안함 SPT - 시행안함
Nasal polyp 검사 안함, PNS 시행안함

Contents

- Over- and underdiagnosis of asthma
- Diagnostic criteria of asthma
- Diagnostic flow
- Summary

Summary

- Asthma diagnosis
  - Typical symptoms + Variable expiratory AFL
    - Documented expiratory AFL
    - Documented excessive variability in lung function

- Different diagnosis

Symptoms	Differential diagnosis
Dyspnea	**Obesity, COPD**, Cardiac disease, deconditioning
Cough	VCD, UACS, GERD, **bronchiectasis**, ACEi
Wheeze	**Obesity, COPD**, Tracheobronchomalacia, VCD

Expiratory AFL (1)

- FEV_1이 감소되어 있을 때 측정한 폐활량
- **FEV_1/FVC < LLN (< 0.75-0.80)**

Excessive variability (2)

Documented excessive variability in lung function	
BDR 양성	FEV_1 > 12% and > 200 mL after 200-400 mcg salbutamol (SABA 4시간, twice-daily LABA 24시간, once-daily LABA 36시간 이상 중단)
Positive challenge test	1. 상용량의 methacholine에서 FEV_1 > 20% 감소 2. 표준화된 과호흡, mannitol, hypertonic saline challenge시 FEV_1 >= 15% 감소 3. 운동 – FEV_1 > 10% 과 200 mL 감소
2주간 PEF의 과도한 변동	Average daily diumal PEF 변화량 > 10%
4주간 치료 후 폐기능 향상	1. FEV_1 > 12% and > 200 mL 2. PEF > 20%
병원 방문시마다 과도한 폐기능 변화	방문 시 FEV_1 > 12%와 > 200mL 변화 (**<u>호흡기 감염 제외</u>**)

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Excessive variability in lung function (On ICS treatment)

Sx	AFL	Approach
O	(O) Variable	천식 진단
O	X	**1. 흡입기 중단 후 BDR test (SABA 4시간, LABA (24-36시간))** **2. FEV_1 < 70% → step-up (3개월) → lung function** **3. FEV_1 > 70% → step-down (2-4주) → PT/BDR test**
Few	X	1. 흡입기 중단 → BDR 2. Step-down → Reassess (증상과 lung function)
O	(O) Persistent	1. Step-up 3개월 → Reassess (증상과 lung function) (e.g. SA, ACO)