

# **INTERESTING case** **in Pulmonary Function Test**

**KANA KASEMSAP**

**Chest Unit**

**Department of Medicine**

**Udonthani Hospital**

# DIAGNOSIS OF ASTHMA

## CASE 1

- ผู้ป่วยชายไทย อายุ 22 ปี อาชีพ นักศึกษา
- ขอใบรับรองแพทย์เพื่อยืนยันว่าตนเป็นหืด ประกอบหลักฐาน  
ขอยกเว้นการเกณฑ์ทหาร
- ไม่มีอาการผิดปกติ แต่มีประวัติว่าตอน 8 ขวบเคยพ่นยาที่ห้อง  
ฉุกเฉินเพราะหอบ
- ตรวจร่างกายปกติ

# DIAGNOSIS OF ASTHMA

## คำถามที่ 1

- ผู้ป่วยรายนี้ สามารถวินิจฉัยว่าเป็นโรคหืดได้เลยหรือไม่

ก. ไม่ได้

ข. ได้

ค. ไม่แน่ใจ

# DIAGNOSIS OF ASTHMA

## ASTHMA SYMPTOMS

Shortness of breath	60%
Wheezing	50%
Cough	30%
Chest tightness	20%
Exercise intolerance	10%
Asymptomatic	10%

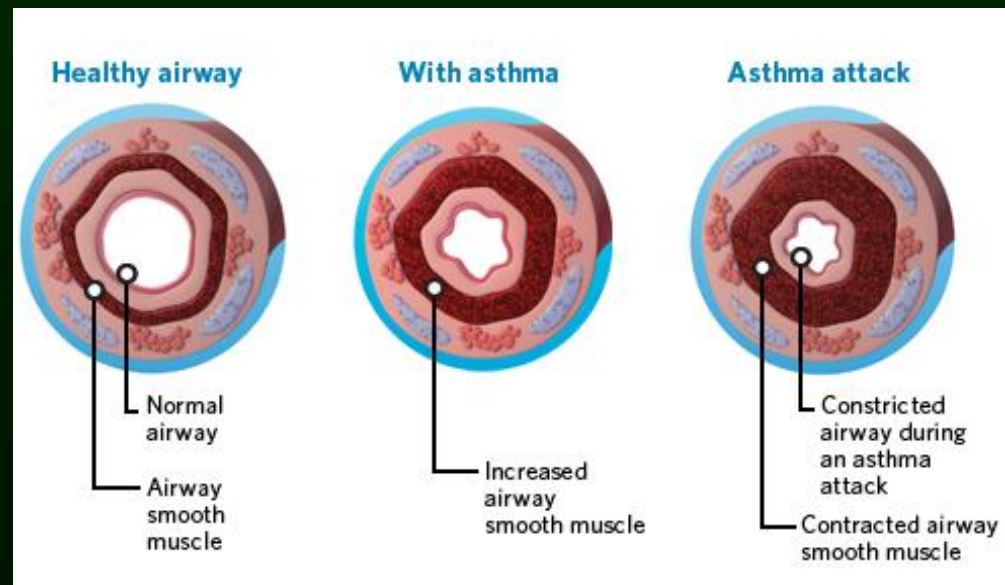
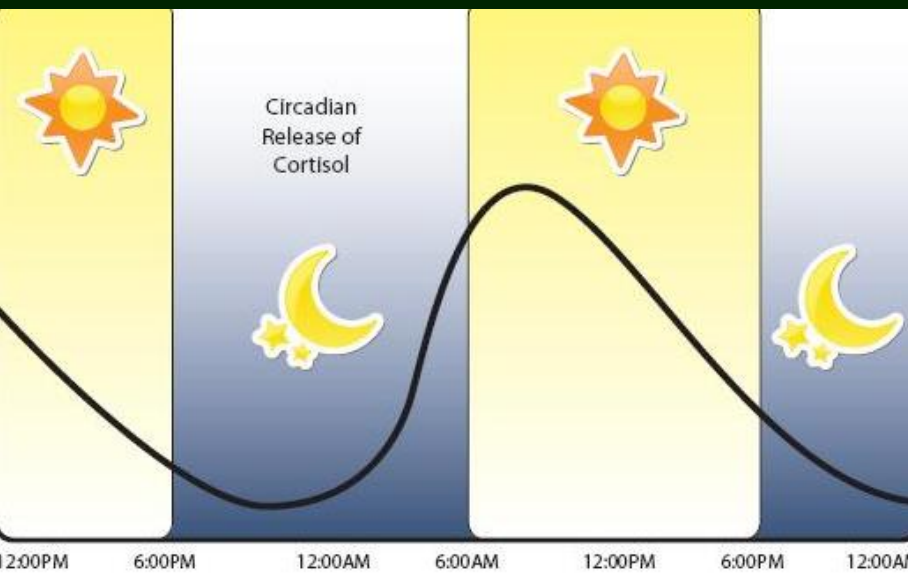
# DIAGNOSIS OF ASTHMA

## ASTHMA DEFINITION : GINA 2016

- Heterogeneous disease
- Characterized by chronic airway inflammation
- History of respiratory symptoms
  - Wheeze / SOB / chest tightness / cough
- Vary over time and intensity
- Variable expiratory airflow limitation
- Trigger factors : exercise, allergen, irritant exposure, change in weather, viral respiratory infection

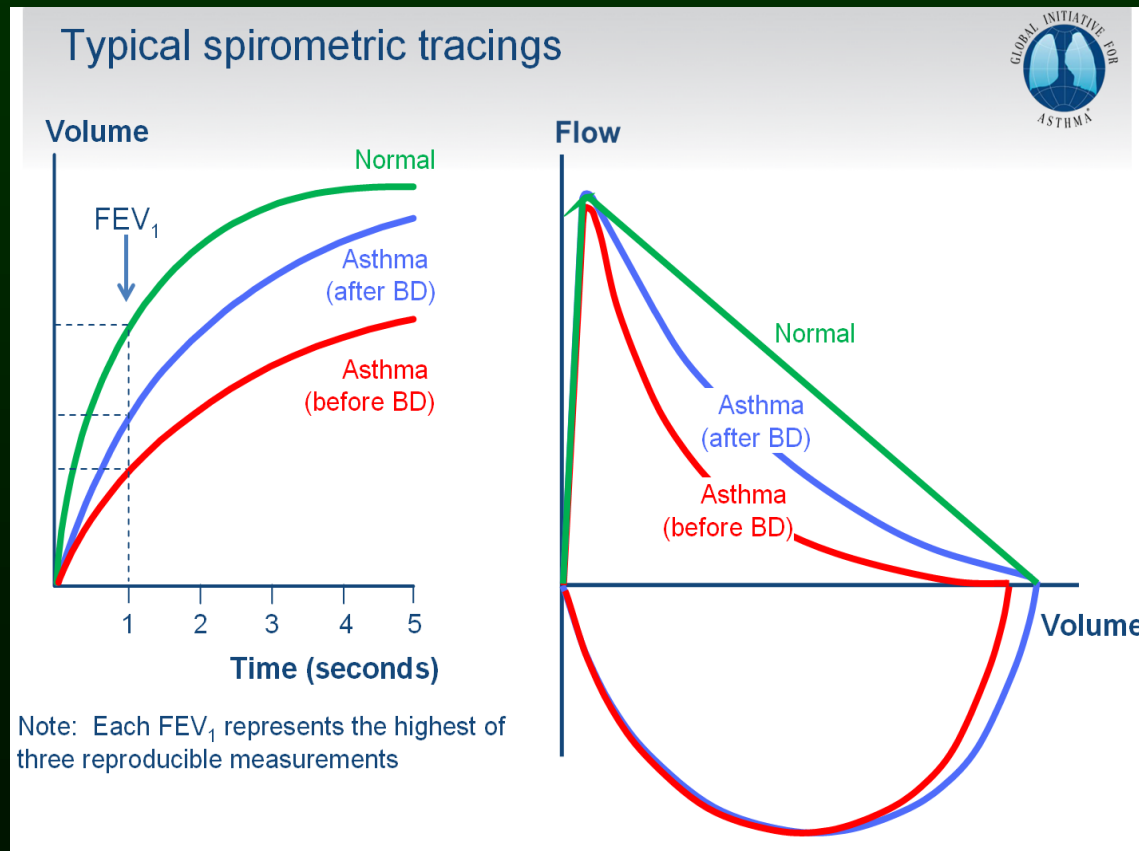
# DIAGNOSIS OF ASTHMA

- The diagnosis of asthma should be based on:
  - A history of characteristic symptom patterns
    - Wheeze / SOB / cough / chest tightness
    - Variable symptoms over time
    - Worse at night or in early morning
    - Trigger factors



# DIAGNOSIS OF ASTHMA

- Evidence of variable airflow limitation, from bronchodilator reversibility testing or other tests



# Diagnosis of asthma – physical examination

- Physical examination in people with asthma
  - Often normal
  - Most frequent finding = wheezing on auscultation, especially on forced expiration
- Wheezing is also found in other conditions, for example:
  - Respiratory infections
  - COPD
  - Upper airway dysfunction
  - Endobronchial obstruction
  - Inhaled foreign body
- Wheezing may be absent during severe asthma exacerbations ('silent chest')

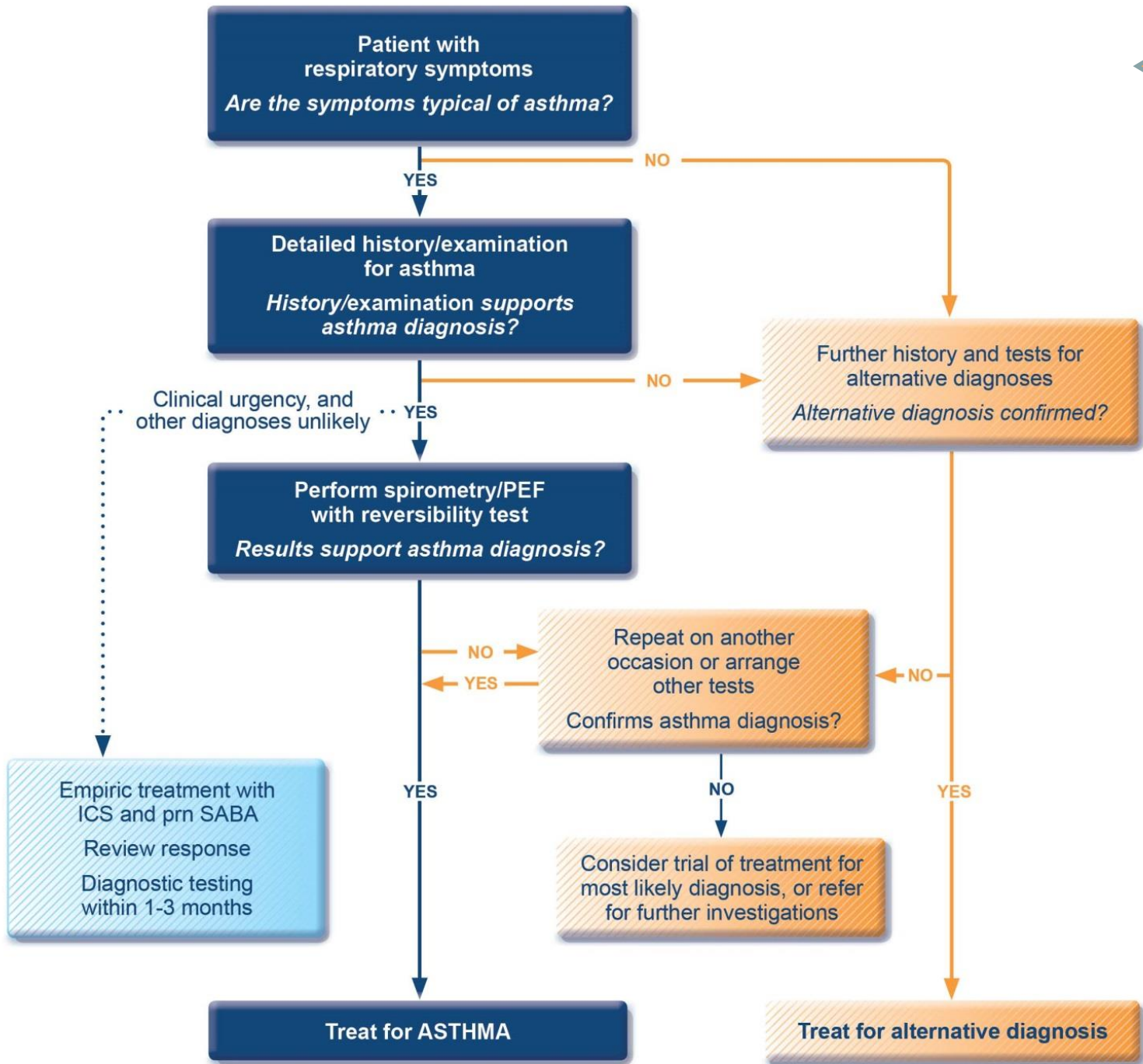
# DIAGNOSIS OF ASTHMA

- Asthma is usually characterized by airway inflammation and airway hyperresponsiveness, but these are not necessary or sufficient to make the diagnosis of asthma
- Bronchoprovocative testing or Bronchial challenge test = Identified Airway Hyperresponsiveness : AHR
- AHR can occur with
  - Asthma
  - URI
  - Bronchitis
  - Bronchiolitis
  - Recent smoking
  - COPD

# DIAGNOSIS OF ASTHMA

## Features increased probability of asthma

- $\geq 1$  symptoms (wheeze, SOB, cough, chest tightness)
- Symptoms often worse at night or in early morning
- Symptoms vary over time and in intensity
- Triggered by viral infection, exercise, allergen, change in weather, irritants such as car exhaust fume, smoke or strong smell



# DIAGNOSIS OF ASTHMA

## คำถามที่ 2

- การยืนยันว่าผู้ป่วยที่เราสงสัยว่าเป็นโรคหืดมี variable expiratory airflow limitation ทำได้อย่างไรบ้าง

ก. Spirometry

ข. Peak flow meter

ค. Bronchial challenge test

# Diagnosis of asthma – variable airflow limitation

- Confirm variation in lung function is greater than in healthy individuals
  - The greater the variation, or the more times variation is seen, the greater probability that the diagnosis is asthma
  - Excessive bronchodilator reversibility
    - Adults: increase in  $FEV_1$   $>12\%$  and  $>200\text{mL}$
    - Children: increase  $>12\%$  predicted)
  - Excessive diurnal variability from 1-2 weeks' twice-daily PEF monitoring (daily amplitude  $\times 100/\text{daily mean}$ , averaged)  $>10\%$
  - Significant increase in  $FEV_1$  ( $>12\%$  and  $200\text{ ml}$ ) or PEF ( $>20\%$ ) after 4 weeks of controller treatment

# Diagnosis of asthma – variable airflow limitation

- Confirm variation in lung function is greater than in healthy individuals
  - If initial testing is negative:
    - Repeat when patient is symptomatic, or after withholding bronchodilators
    - Refer for additional tests (especially children  $\leq 5$  years, or the elderly)

## 2. Confirmed variable expiratory airflow limitation

Documented excessive variability in lung function\* (one or more of the tests below)

**AND** documented airflow limitation\*

The greater the variations, or the more occasions excess variation is seen, the more confident the diagnosis

At least once during diagnostic process when FEV<sub>1</sub> is low, confirm that FEV<sub>1</sub>/FVC is reduced (normally >0.75–0.80 in adults, >0.90 in children)

Positive bronchodilator (BD) reversibility test\* (more likely to be positive if BD medication is withheld before test: SABA ≥4 hours, LABA ≥15 hours)

*Adults:* increase in FEV<sub>1</sub> of >12% and >200 mL from baseline, 10–15 minutes after 200–400 mcg albuterol or equivalent (greater confidence if increase is >15% and >400 mL).

*Children:* increase in FEV<sub>1</sub> of >12% predicted

Excessive variability in twice-daily PEF over 2 weeks\*

*Adults:* average daily diurnal PEF variability >10%\*\*

*Children:* average daily diurnal PEF variability >13%\*\*

Significant increase in lung function after 4 weeks of anti-inflammatory treatment

*Adults:* increase in FEV<sub>1</sub> by >12% and >200 mL (or PEF<sup>†</sup> by >20%) from baseline after 4 weeks of treatment, outside respiratory infections

Positive exercise challenge test\*

*Adults:* fall in FEV<sub>1</sub> of >10% and >200 mL from baseline

*Children:* fall in FEV<sub>1</sub> of >12% predicted, or PEF >15%

Positive bronchial challenge test (usually only performed in adults)

Fall in FEV<sub>1</sub> from baseline of ≥20% with standard doses of methacholine or histamine, or ≥15% with standardized hyperventilation, hypertonic saline or mannitol challenge

Excessive variation in lung function between visits\* (less reliable)

*Adults:* variation in FEV<sub>1</sub> of >12% and >200 mL between visits, outside of respiratory infections

*Children:* variation in FEV<sub>1</sub> of >12% in FEV<sub>1</sub> or >15% in PEF<sup>†</sup> between visits (may include respiratory infections)

# DIAGNOSIS OF ASTHMA

## Confirm variable expiratory airflow limitation

Test	Result
Positive bronchodilator reversibility test	↑ FEV1 >12% and > 200 ml from baseline 10-15 min after inhaled 200-400 mcg of albuterol Greater if ↑ > 15% and > 400ml
Excessive twice-daily PEF over 2 weeks	Diurnal PEF variability > 10%
Significant increased in lung function after 4 wk of anti-inflammatory treatment	↑ FEV1 >12% and > 200 ml or PEF > 20%
Positive bronchial challenge test	Fall in FEV1 ≥ 20% from baseline with standard dose of methacholine or histamine

# DIAGNOSIS OF ASTHMA

## คำถามที่ 2

	Pre - BD	
		%predicted
FEV1	3.6	95
FVC	4.8	100
FEV1/FVC	0.75	86
FEF25-75	3.22	70
PEF	550 LPM	92

# DIAGNOSIS OF ASTHMA

## คำถามที่ 2

	Pre - BD		Post - BD	
		%predicted		%predicted
FEV1	3.6	95	4.1	138
FVC	4.8	100	5.0	145
FEV1/FVC	0.75	86	0.82	93
FEF25-75	3.22	70	4.01	87
PEF	550 LPM	92	680	114

# การวินิจฉัยผู้ป่วยโรคหืด

การตรวจด้วยเครื่องมือเฉพาะเพื่อยืนยันการวินิจฉัยโรคหืดที่แนะนำ

TAC แนะนำว่าผู้ป่วยที่มีอาการเข้าได้กับโรคหืด ควร ส่งตรวจทางห้องปฏิบัติการเพื่อยืนยันการวินิจฉัยโรค โดยควรเลือก spirometry เป็นอันดับแรก แต่ ถ้าไม่มี เลือก peak expiratory flow ก็ได้

Peak Flow Meter : Peak flow reversibility test

Peak flow variability test

# Mini-Wright Peak Flow Meter





# การวินิจฉัยผู้ป่วยโรคหืด

## Peak Flow Meter :

Peak flow reversibility test

$$= \frac{\text{Post BD PEFR} - \text{Pre BD PEFR}}{\text{Pre BD PEFR}} \times 100$$

If > 20% or มากกว่าเดิม 60 LPM = Positive BD response

# การวินิจฉัยผู้ป่วยโรคหืด

## Peak Flow Variability :

$$\text{Diurnal Peak flow variability test} = \frac{\text{Max PEFR} - \text{Min PEFR}}{\frac{\text{Max PEFR} + \text{Min PEFR}}{2}} \times 100$$

If > 10% = Peak Flow Variability test positive

Minimal morning pre-bronchodilator Peak expiratory flow

$$= \frac{\text{Min PEFR}}{\text{Max PEFR}} \times 100$$

If < 80% = Peak Flow Variability test positive

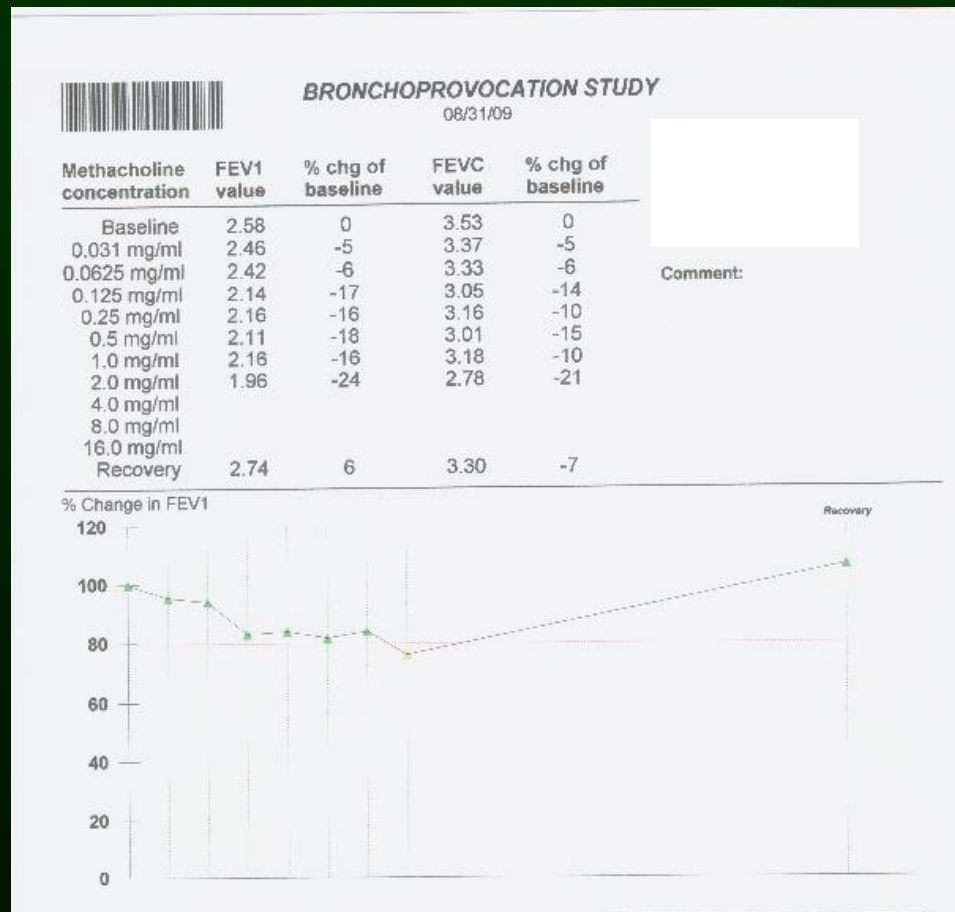
# การวินิจฉัยผู้ป่วยโรคหืด

- Peak expiratory flow record

วัน / เดือน / ปีภคจ	Morning PEFR	Evening PEFR	Interpretation
1	420	550	Max PEFR = 550
2	440	450	Min PEFR = 420
3	450	500	Diurnal peak flow variability = $\frac{550 - 420}{(550 + 420) / 2} \times 100 = 27\%$
4	480	550	
5	440	520	
6	500	480	
7	430	480	

# การวินิจฉัยผู้ป่วยโรคหืด

- Methacholine Challenge Test





**THANK YOU**