

# Diagnostic test in asthma and allergy

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# INTRODUCTION

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Skin allergy testing is a method for medical diagnosis of allergies that attempts to provoke a small, controlled, allergic response.

Allergy skin tests are used to find out which substances cause a person to have an allergic reaction.

Skin testing is usually done at a doctor's office. A nurse generally administers the test, and a doctor interprets the results. Typically, this test takes about 20 to 40 minutes. Some tests detect immediate allergic reactions, which develop within minutes of exposure to an allergen. Other tests detect delayed allergic reactions, which develop over a period of several days.

# TYPES

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- SKIN PRICK TEST

- SKIN SCRATCH TEST

} Immediate  
reaction  
test

- PATCH TEST

⇒ Delayed  
reaction test

- INTRADERMAL TEST

⇒ Skin end point  
titration

## SKIN PRICK/ SCRATCH TEST

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A skin prick test, also called a puncture or scratch test, checks for immediate allergic reactions to as many as 40 different substances at once. This test is usually done to identify allergies to pollen, mold, pet dander, dust mites and foods. In adults, the test is usually done on the forearm. Children may be tested on the upper back.

Allergy skin tests aren't painful. This type of testing uses needles (lancets) that barely penetrate the skin's surface. You won't bleed or feel more than mild, momentary discomfort.



# Immunoassay vs skin test for diagnosis of allergy

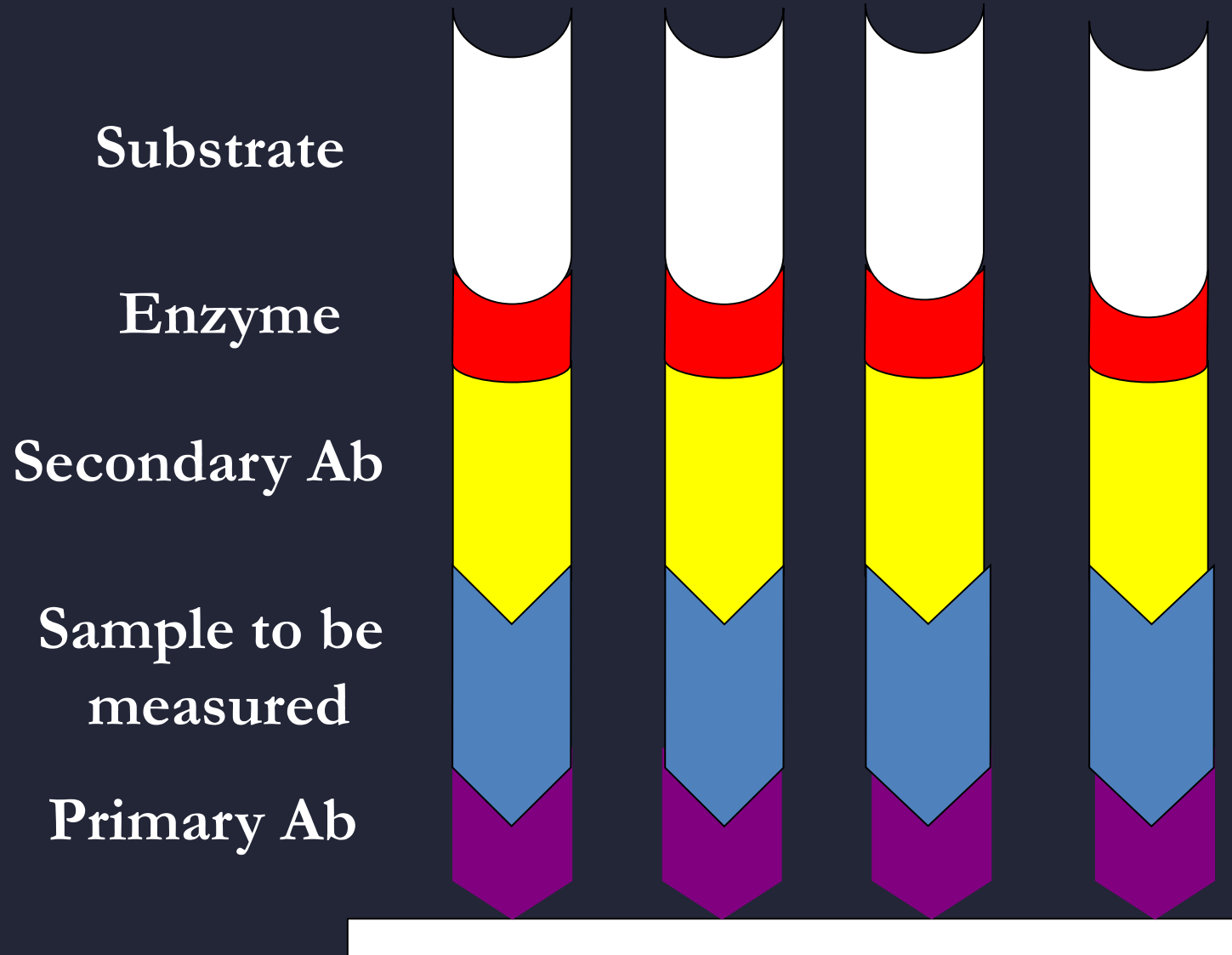
## Immunoassay

- Not influenced by medication
- Not influenced by skin disease
- Does not require expertise
- Quality control possible
- Expensive

## Skin test

- Higher sensitivity
- Immediate results
- Requires expertise
- Cheaper

# Concept of In Vitro IgE assays



## NOTE

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To see if your skin is reacting normally, two additional substances are scratched into your skin's surface:

- Histamine. In most people, this substance causes a skin response. If you don't react to histamine, your allergy skin test may not reveal an allergy even if you have one.
- Glycerin or saline. In most people, these substances don't cause any reaction. If you do react to glycerin or saline, you may have sensitive skin. Test results will need to be interpreted cautiously to avoid a false allergy diagnosis.

## PROCEDURE

- After cleaning the test site with alcohol, the nurse draws small marks on your skin and applies a drop of allergen extract next to each mark. He or she then uses a lancet to prick the extracts into the skin's surface. A new lancet is used for each allergen.





## RESULT

- About 15 minutes after the skin pricks, the nurse observes your skin for signs of allergic reactions. If you are allergic to one of the substances tested, you'll develop a raised, red, itchy bump (wheal) that may look like a mosquito bite. A nurse will then measure the bump's size.
- After the nurse records the results, he or she will clean your skin with alcohol to remove the marks.



# Allergy skin prick testing

Skin prick test / positive result



Wheal size (mm)	Old "+" scale	Interpretation
<4	0+	Negative
5-10	2+	Mildly sensitive
10-15	3+	Moderately sensitive
>15	4+	Very sensitive





## **INTRADERMAL TEST**

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- ❖ This is a skin end point titration (SET) which uses intradermal injection of allergens at increasing concentrations to measure allergic response.
- ❖ The intradermal test is sensitive more than the skin prick test
- ❖ To prevent a severe allergic reaction, the test is started with a very dilute solution. After 10 minutes, the injection site is measured to look for growth of wheal, a small swelling of the skin.
- ❖ Two millimeters of growth in 10 minutes is considered positive. If 2 mm of growth is noted, then a second injection at a higher concentration is given to confirm the response.
- ❖ The end point is the concentration of antigen that causes an increase in the size of the wheal followed by confirmatory whealing. If the wheal grows larger than 13 mm, then no further injection are given since this is considered a major reaction.





Intradermal allergy test reactions



## PATCH TEST

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- Patch testing is generally done to see whether a particular substance is causing allergic skin irritation (contact dermatitis). Patch tests can detect delayed allergic reactions, which can take several days to develop.
- Patch tests don't use needles. Instead, allergens are applied to patches, which are then placed on your skin. During a patch test, your skin may be exposed to 20 to 30 extracts of substances that can cause contact dermatitis. These can include latex, medications, fragrances, preservatives, hair dyes, metals and resins.

You wear the patches on your arm or back for 48 hours. During this time, you should avoid bathing and activities that cause heavy sweating. The patches are removed when you return to your doctor's office. Irritated skin at the patch site may indicate an allergy









## PRE TEST REQUISITES

- ◉ Stop all anti immunosuppressants if feasible.
- ◉ Systemic agents before 3 months.
- ◉ Biologics before 6 months.
- ◉ Topical corticosteroids before 2 weeks.
- ◉ Prednisolone < 15mg according to ROOK'S TEXTBOOK OF DERMATOLOGY and prednisolone < 10mg according to BRITISH ASSOCIATION OF DERMATOLOGISTS can be continued.
- ◉ Discontinuation of antihistamines is desirable before 48 hours.

## PRETEST ADVICE

- ⦿ Prohibition of wetting the back.
- ⦿ Prohibition of performing activities that increase sweating.
- ⦿ Probable local symptoms such as itching .
- ⦿ Prohibition of exposing themselves to UVR upto fifteen days prior to testing.

- ⊙ Test site-Back

Lateral aspect of upper arm

- ⊙ Exposure time- 48 hour application time with readings taken 1 hour after removal and then 48 hours later. Day 2 and day 4.
- ⊙ If only 1 patch test reading- day 4.
- ⊙ 3<sup>rd</sup> reading- 5 to 7 days if possible.

**Table 128.8** Recording of patch-test reactions according to the International Contact Dermatitis Research Group scoring system.

Score	Description
–	Negative
?+	Doubtful reaction; faint erythema only
+	Weak positive reaction; palpable erythema, infiltration, possibly papules
++	Strong positive reaction; erythema, infiltration, papules, vesicles
+++	Extreme positive reaction; intense erythema and infiltration and coalescing vesicles
IR	Irritant reaction of different types
NT	Not tested



## ANGRY BACK/ EXCITED SKIN SYNDROME

- ◉ Positive reaction to more than five non related substances.
- ◉ Poly sensitization.
- ◉ Repeat testing of selected allergens two months later.

## Box 128.8 Causes of false negative reactions

- Insufficient concentration
- Insufficient amount applied
- Poor adhesion of patches
- Patches applied at wrong site
- Inappropriate vehicle
- Readings performed too early
- Substance degraded
- Pretreatment of patch test site with topical corticosteroids
- UV irradiation of patch-test site
- Systemic treatment with immunosuppressants

# PHOTO-PATCH TEST

- ⊙ The allergens are tested in duplicate on back and irradiated with UV light( most often UV-A 5j/cm<sup>2</sup>)
- ⊙ 1<sup>st</sup> reading- immediately post irradiation.
- ⊙ 2<sup>nd</sup> reading- 2 days post irradiation.

# COMPLICATIONS

## **Box 128.9 Potential complications of patch testing**

- Pruritus
- Folliculitis
- Leakage of materials on to clothing, especially dyes
- Localized flare of dermatitis and other skin disorders
- Flare of dermatitis at previous contact sites
- Generalized flare of dermatitis
- Irritant reactions from patients' own inappropriately diluted products
- Active sensitization
- Pigmentation or depigmentation
- Scarring
- Anaphylaxis (very rare)



# Allergic Contact Dermatitis

- ACD occurs when contact with a substance elicits a delayed hypersensitivity reaction
- The sensitization process takes 10-14 days
  - Re-exposure, dermatitis in 12-48 hours
- Most common culprits are poison ivy, poison oak or poison sumac (all contain the resin – urushiol)
- Rhus Dermatitis

# Etiology

- Approximately 25 chemicals appear to be responsible for as many as one half of all cases of allergic contact dermatitis.
- These include:
  - Nickel: leading cause of ACD in the world
  - Preservatives: Preservative chemical added to cosmetics, moisturizers & topical medications
  - Dyes in textiles
  - Fragrances: perfumes, colognes, aftershaves, deodorants & soaps

## Identifying Allergens

- Not all patients with ACD need patch testing
- Patch testing should be done when the allergen is unknown or the dermatitis chronic
- A positive reaction on patch testing does not definitively mean that the patient's rash is due to that specific allergen.
- Elimination of the rash with removal of the allergen confirms the clinical significance of the positive patch test

## Positive Patch Test Reaction



From left to right: +++ reaction; ++ reaction (note the microvesicles); + reaction; +/- reaction.





# Interpreting Patch Testing

- Negative (-)



- Weak positive (+)



- Irritant reaction (IR)



- Strong positive (++)



- Equivocal / uncertain (+/-)



- Extreme reaction (+++)





## Results

- Irritant reactions include sweat rash, follicular pustules and burn-like reactions.
- Uncertain reactions refer to a pink area under the test chamber.
- Weak positives are slightly elevated pink or red plaques
- Strong positives are 'papulovesicles' and extreme reactions are blisters or ulcers.

The interpretation of the results requires considerable experience and training.

# **Spirometry**

## **(Pulmonary Function Tests)**

# **Definition**

**A physiological test for measuring volumes inhaled or exhaled by an individual as a function of time**

# Indications (diagnostic)

- Evaluation of symptoms and signs
- Measuring the effect of dis. on pulmonary function
- Screening individuals at risk for pulmonary dis.
- Assess preoperative risk
- Assess health status before physical activities (e.g. work)



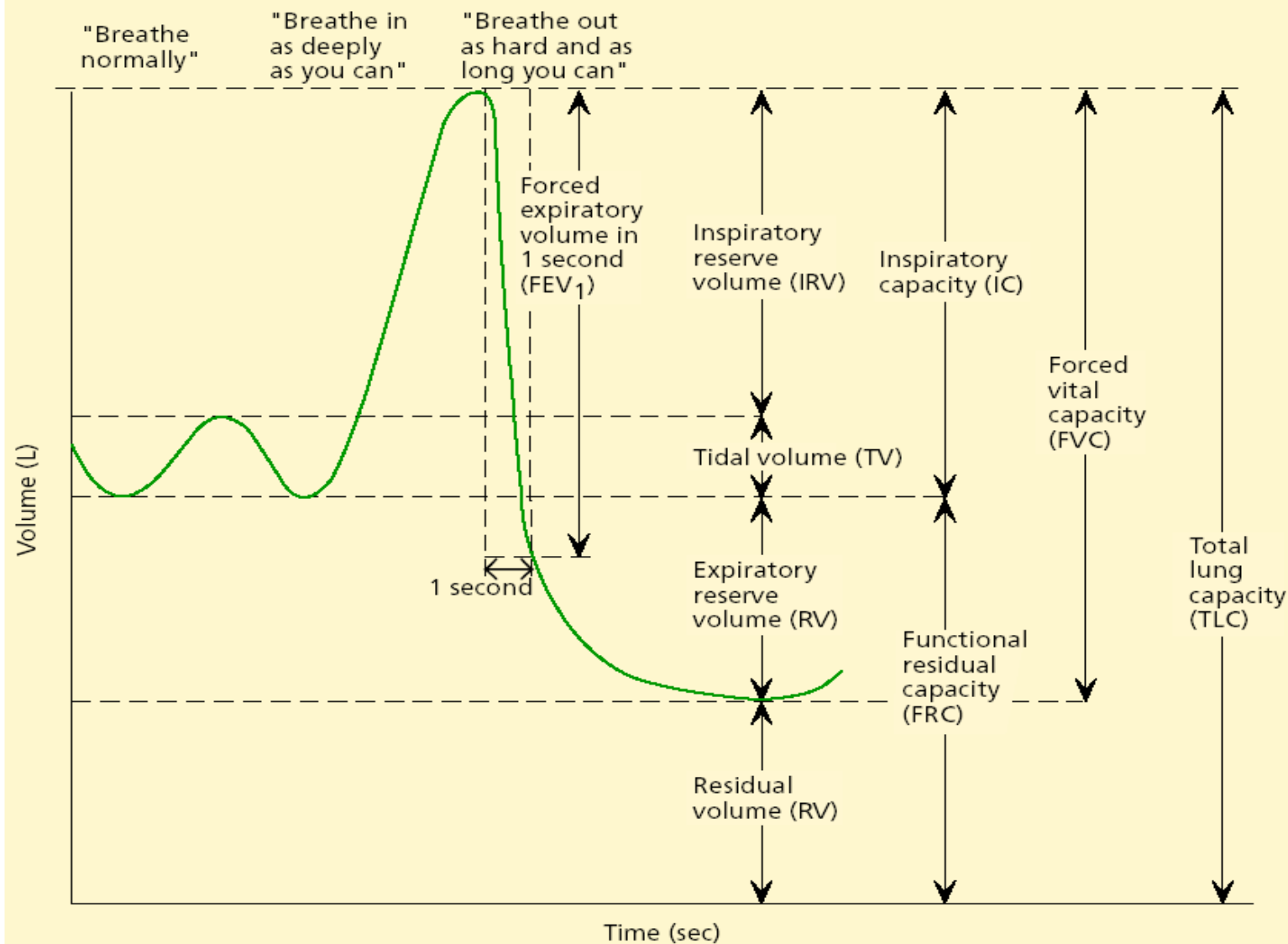
# **Contraindications of Spirometry**

- **Uncontrolled hypertension**
- **Suspected presence of active TB or other communicable respiratory disease**
- **Thoracic or abdominal surgery within recent 3 wks**
- **MI or unstable angina within recent 6 wks**
- **Respiratory distress**
- **Active hemoptysis**
- **Recent eye/ear surgery**
- **Abdominal or thoracic aortic aneurysm**

# **Interfering condition**

- **Acute illness or cold during the past few days**
- **Any respiratory infection during the past 3 weeks**
- **Heavy meal during the past 1-2 hour**
- **Cigarette smoking during the past 1 hour**

## Lung volumes and capacities



**FIGURE 1.** Lung volumes and capacities depicted on a volume-time spirogram. The most important values are the forced vital capacity (FVC), the forced expiratory volume in 1 second ( $FEV_1$ ), and the  $FEV_1/FVC$  ratio. Spirometry cannot measure the residual volume or the total lung capacity.

**The three most important measures are the:**

- FVC
- $FEV_1$
- $FEV_1/FVC$  ratio

# Reversibility testing

1. Stop drugs (short-acting for 4 h, long-acting for 12h) before test
2. Stop smoking for 1 h. before test
3. Perform baseline test
4. Administer drug
5. Perform test after 10 – 15 min. (for salbutamol) or after 30 min. (for ipratropium)



# Key Notes

6. The severity of airway obstruction should be based on  $FEV_1$ .
7. When  $FEV_1$  and  $FEV_1/VC$  are normal, don't use  $FEF_{25-75}$  for grading the severity of obstruction.
8. A reduced VC and normal  $FEV_1/VC$  suggest but not diagnose the presence of restriction.
9. The severity of restriction should be based on TLC. If VC is used, severity may be based on VC.

# Lower Limits of Normal

- $FEV_1$  and FVC = 80%
- $FEV_1/FVC = 70-75\%$
- $FEF_{25-75} = 50-60\%$

# Interpretation

**A. Normal:** both the VC and the  $FEV_1/VC$  ratio are normal.

**B. Obstructive:**  $FEV_1/VC$  ratio is below the normal range.

The severity of the abnormality is graded:

- % Pred  $FEV_1 > 100$  = May be a physiological variant
- % Pred  $FEV_1 < 100$  and  $> 70$  = Mild
- % Pred  $FEV_1 < 70$  and  $> 60$  = Moderate
- % Pred  $FEV_1 < 60$  and  $> 50$  = Moderately severe
- % Pred  $FEV_1 < 50$  and  $> 34$  = Severe
- % Pred  $FEV_1 < 34$  = Very severe

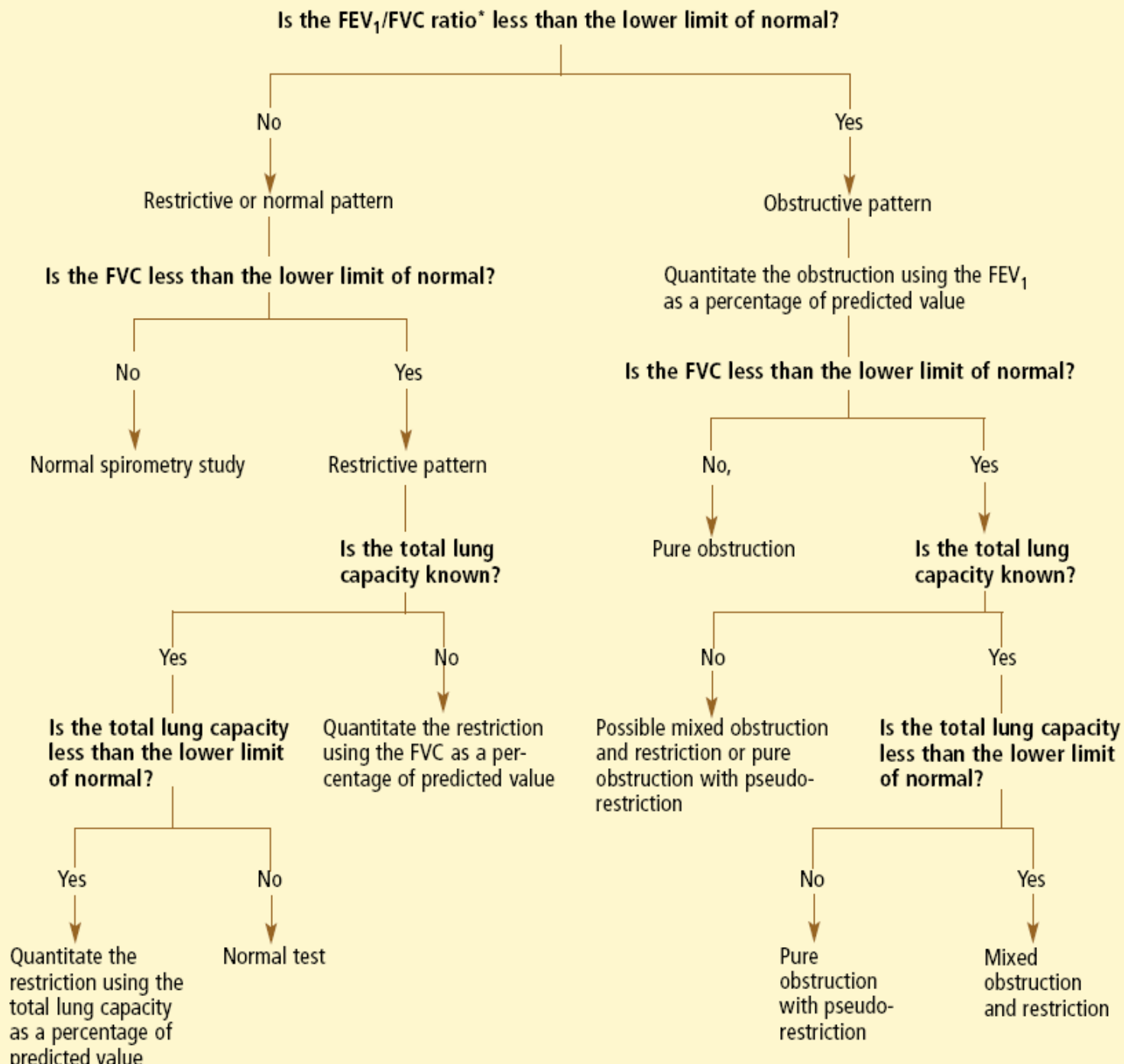
# Interpretation

C. Restrictive: This is most reliably interpreted on the basis of TLC. If this is not available, one may interpret a reduction in the VC without a reduction of the  $FEV_1/VC$  ratio as a restriction

The severity of the abnormality might be graded as follows:

- % Pred VC < LLN and > 70 = mild
- % Pred VC < 70 and > 60 = Moderate
- % Pred VC < 60 and > 50 = Moderately severe
- % Pred VC < 50 and > 34 = Severe
- % Pred VC < 34 = Very severe







THANK YOU