

Rast and Eucast in Blood Test- A Review

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Abstract

An allergic response is the hypersensitive immune response to a substance which is normally harmless or would not cause an immune response in everyone. An allergic response can cause several symptoms such as itching, inflammation and tissue injury. The manifestation of allergies is recognized in the form of urticaria, swelling, burning, pain, and dryness of the mucosa, stomatitis. radioallergosorbent test (RAST) which is the radioallergosorbent test used for the confirmation of allergic reaction in the body. This test specifically deals with the IgE antibodies which are responsible for the allergic reactions on the body. It is very essential to cross-check the exact history related to allergy. Individual sensitivity and population sensitivity, both are equally responsible for skin allergy are the factors which are to be considered. Skin tests become negative under conditions of severe allergic reactions which is determined by graded therapy by freedom from contact and using epinephrine administration. RAST test is a two-stage procedure. RAST- test is performed according to the guidelines of European Committee on Antimicrobial Susceptibility (EUCAST). The reliability of the test is high compared to other skin tests. Specificity based on two radioallergosorbent tests is high as 90% for inhaled allergens. It shows excellent reproducibility across a full measuring range with the help of the calibration curve. The RAST test is considered to be extremely sensitive. It shows high specificity which binds to allergen-specific IgE. This article mainly deals with the RAST procedure, advantages and disadvantages of the test.

Keywords: RAST test, EUCAST protocols, skin allergy, contamination.

Introduction

The RAST test is defined as a radioallergosorbent test. EUCAST is a committee that stands for “European Committee on Antimicrobial Susceptibility Testing”. The first clinical case on allergy was reported by Dr. John Bostock in 1819. RAST test is used for the detection of specific IgE antibodies which are responsible for allergic reactions on the body. IgE which is an immunoglobulin

is produced in two forms in our body. One is secreted as an alternative splicing form and the other form is the membrane-bound form ¹. Individual sensitivity and population sensitivity, both are equally responsible for the causation of skin allergy are the factors which are to be considered. It is very essential to cross-check the exact history related to allergy. Various clinical examinations should be performed via specific confirmatory tests. The difference in structure present between IgE constant domains along with all other immunoglobulin classes is mainly concerned. Physical effects of allergic reactions in certain tissues can trigger the mutagenic triggers before transformation of malignant cells occur. Radiation therapy is given in order to avoid the cancer cell growth and division, thus killing the cancer cells. This therapy can lead to destruction of a normal blood cell due to exposure of ionising radiation ². Buccal smear is useful for diagnosing Malignancy, dermatoses.

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Liquid paraffin as a rehydrant for air dried buccal smear³. The amount of hemoglobin is determined spectrophotometrically. These RBC cells are developed from hematopoietic stem cells which shows alteration with respect to age, sex, and dental diseases^{4,5}. For the diagnosis of malignancy such as breast cancer, ovarian cancer blood test is taken as initial step^{6,7}. Expert rules of the EUCAST committee were designed to assist the clinical microbiologists and to describe specific actions that are to be taken in response to antimicrobial susceptibility tests which in turn result in a more specific outcome⁸. These include the recommendations on topics such as reporting, which include responding to inferring susceptibility against agents from results with one, result suppression which might be inappropriate, and editing of results from intermediate to resistant or from susceptible to intermediate or resistant based on inferred resistance mechanism. It is based on current microbiological and/or clinical evidence. EUCAST expert rules also include the exceptional resistance phenotypes and intrinsic resistance phenotypes. These phenotypes have not yet been reported and it's rare⁹. The execution of the EUCAST expert rules is mostly dependent on MIC breakpoints which are used to define rules. Setting up of pertinent clinical breakpoints, which is based on patient's treatment and particularly not on the mechanisms of resistance detection. This may cause specific modification of some expert rules in the future and leads to success. The knowledge on diagnosis of the disease prognosis is very important. Several methods are used to obtain proper knowledge of specimen slides such as game based learning about the morphological features rather than using conventional slide methods. Even popplet notes are used widely comparing popplet notes while learning about the prognosis of disease and Rast test changes^{10,11}. There is a requirement of personal protective measures such as helmet, face mask, head cap, safety shoes, gloves in order to avoid contamination while collecting the blood sample¹². This review article deals with the importance of the RAST test in case of allergy and differentiation of this test with a normal skin test to analyze the merits and demerits of EUCAST and RAST in a blood test. Literature searches were limited to studies about RAST sample collection, maintenance, advantages, and disadvantages.

RAST AND EUCAST

Allergic Response:

Skin testing and allergy blood testing are used in confirming allergen sensitization¹³. Indoor allergens are damp old mattresses, unwashed pillows, and duvet, apple cider vinegar, close contact with pets, cigarette smoke, gas-fired cooking stoves, boilers^{14,15}. Outdoor allergens are density, grass or tree pollen, exposure to roadways, or power stations¹⁶. Occupational allergens are contacted with isocyanate, flour, laboratory animals, resin-wood dust, biological enzymes, latex usage, etc¹⁷. skin testing with penicillin skin test reagent was proven to be very reliable in predicting the risk of anaphylactic reaction with penicillin. Other types of allergic responses can also be noticed under hysterectomy conditions mainly in women¹⁸ and even after the application of particular vaccines. Prausnitz and Kushner were first to find the transferrable tissue sensitizing factor in serum responsible for allergic reactions. IgE in the body is produced in two forms such as an alternative splicing form which is secreted and the other is the membrane-bound form¹⁹. Ingredients in dental amalgam (including mercury), bonding, or porcelain can result in redness, swelling, and irritation of the gums^{20,21}. In sensitized atopic individuals it can be noticed that allergic response induces cross-linking of high affinity²². The manifestation of allergies is recognized in the form of urticaria, swelling, burning, pain, and dryness of the mucosa, stomatitis. It may cause life-threatening conditions such as laryngeal edema, anaphylaxis, and cardiac arrhythmias, hypertension. Individual sensitivity and population sensitivity, both are equally responsible for skin allergy are the factors which are to be considered. It is confirmed that there is no use of probiotics and vaccines for the control of allergic reaction²³. It is essential to obtain proper history, related to allergy and clinical examination should be done using various confirmatory tests²⁴. Skin biopsy is done to understand the histopathologic changes that occur in Hansen's disease²⁵.

Rast Test Vs Other Skin Tests:

The two main allergy tests are skin tests and blood tests to detect an allergic response in the body. A scratch test is the most common allergy test against a tiny bit of an allergen on the skin by pricking the outer layer of skin and making a small scratch on the skin²⁶. Percutaneous

skin testing is the most common- screening method used at present²⁷. Intradermal testing (ID) is done for aeroallergens which show negative Production screen test. Skin test requires the discontinuation of antihistamines which have antihistaminic effect at regular intervals ranging from days to weeks before testing²⁸. RAST may be preferred over skin tests^{29,30}. Special test for food allergy which was introduced by Kolmannskog and Haneberg in 1986³¹. Skin tests become negative under conditions of severe allergic reactions which is determined by graded therapy by freedom from contact and using epinephrine administration³². A skin prick test is the puncture test while the scratch test is used to check immediate allergic reactions of 50 different substances at once³³. Skin prick test is usually done to identify allergies such as pollen, mold, pet dander, dust mites, and foods. In adults, this test is usually done on the forearm³⁴.

Rast Procedure:

RAST test is a two-stage procedure. The first stage is the collection of a patient's serum as a source from which the IgE antibody is recognized. It is reacted with an allergen which has been covalently coupled to a solid-phase support system, most commonly a filter paper disk or microcrystalline cellulose particles, Sephadex particles, or agarose³⁵. Once the incubation period is over, washing of the solid-phase allergen is done to remove the nonspecific serum components. Then the IgE antibody which is attached to solid-phase is reacted with a radiolabeled anti-IgE antibody in the second stage; after another overnight incubation, the complex is washed again and counted in a gamma scintillation counter³⁶. The number of radioactive counts present is directly proportional to the amount of IgE antibody which was present to the particular solid-phase allergen. Thus, the reaction depends on two critical reagents, the insolubilized antigen and the radiolabeled anti-IgE³⁷. The most common method used to prepare the solid-phase allergen is to react to the allergen solution with cyanogen bromide-activated polysaccharides. The procedure we use with the filter paper disks is a little different and is essentially the method that is used by workers at Beecham Laboratories in England.

Eucast Guidelines: EUCAST is the European Committee on Antimicrobial Susceptibility Testing.

The most objectives of EUCAST are to harmonize antimicrobial breakpoints in Europe³⁸ and to act because the breakpoint committee for the EU Medicines Agency (EMA) during the registration of latest antimicrobial agents, as defined in an exceedingly Standard procedure agreed between the EMA, EUCAST and also the pharmaceutical industry in 2005³⁹. The responsibility for the development of harmonized breakpoints rests with the Steering Committee along with consultation regarding the national breakpoint committees, the EUCAST General Committee, the susceptibility testing devices manufacturers, and the pharmaceutical industry⁴⁰. The International Standards Organization (ISO) is currently developing a worldwide standard to see MICs by microdilution⁴¹. EUCAST breakpoints are going to be implemented within the susceptibility testing systems of the national breakpoint committees in Europe. Disk-diffusion susceptibility testing methods that implement EUCAST breakpoints include the BSAC⁴², CA-SFM, and SRGA systems. Antimicrobial resistance surveillance systems in which MIC values are collected can start using EUCAST epidemiological cut-off values and clinical breakpoints as they become available. The consequences of adjusting breakpoints may be assessed by retrospective comparison of knowledge interpreted by previous breakpoints and by EUCAST breakpoints

Uses in Various Disease:

There is vast usage of the RAST test in the detection of allergens nowadays. Allergic disorders could protect the body against cancer development via promoting immune surveillance⁴³. IgE could stimulate the production of reactive oxygen metabolites and nitric oxide, which are important in tumor eradication⁴⁴. Some of the diseases and allergies in which RAST test is used are tested to detect the presence of new aeroallergens— e.g. *Parietaria Judaica* - southern England, allergic rhinitis which is one of the lower respiratory tract⁴⁵, the conjunctival allergic responses⁴⁶, several skin allergies, stye⁴⁷, gastrointestinal tract allergies, which are frequently affected by the allergic disease⁴⁸. It is also useful in the improvement of the treatment outcome in several allergic diseases such as asthma, a common respiratory illness⁴⁹. It is also used in the detection of the COVID-19 disease which is an infectious disease that spreads through air droplets and causes respiratory illness affecting mostly the respiratory organ. Immediate

hypersensitivity to insulin is a rare condition among patients suffering from type 2 diabetes mellitus, particularly after the development of recombinant human insulins, which are less immunogenic than former animal preparations⁵⁰. Atopic dermatitis in which rashes are developed that appears to be a severe exacerbation of eczema after application of vaccinations can be tested through the RAST test. Even in disease conditions like Alibert-Bazin syndrome or granuloma fungoides, is the most common form of cutaneous T-cell lymphoma, which generally affects the skin, but may progress internally over time it is used. Nocturia is the condition of frequent urination during night and can be noted during diabetes mellitus⁵¹. Noctiva is used to treat nocturia. Noctiva caused several side effects such as nasal congestion, sneezing, bronchitis, dizziness⁵². RAST test is used in the diagnosis of the allergic reaction caused by given noctiva.

Advantage:

The reliability of the RAST test is high⁵³. It is not influenced by any concurrent drug treatment. It is performed when there is a widespread skin disease that is more prevalent. It is one the completely safest test to undergo for the allergic response⁵⁴. Specificity based on two radioallergosorbent tests is high as 90% for inhaled allergens. It shows excellent reproducibility across a full measuring range with the help of the calibration curve. It shows high specificity which binds to allergen-specific IgE⁵⁵. The RAST test is considered to be extremely sensitive. Another type of RAST test is CAP-RAST with allergens which are covalently coupled using a cellulose carrier over a large surface area. The patient's serum containing IgE is added to specific IgE reacts with the bound allergen. Non-specific IgE is washed away by enzyme-labeled antibodies against human IgE which is added with a bound complex that is incubated by fluorescence substrate⁵⁶. This test is perceived as a "Gold standard" for in vitro IgE testing.

Disadvantage of RAST test :

The RAST test takes longer to perform. It is also less cost-effective. It is less sensitive than skin testing for detection for clinically relevant allergies. Sometimes it shows false-positive results that are obtained due to cross-reactivity between homologous proteins which are cross-reactive with carbohydrate determinants⁵⁷. The

predictive values associated with the RAST test shows clinical evidence of allergy using ImmunoCAP which cannot be applied to other test methods⁵⁸. The awareness of perception and knowledge on hematological report plays a major role in determination of allergic response and diagnosis of the disease.

Conclusion

The above article determines the advantage and disadvantages of the RAST test and the exact view on how the test is performed. This test is widely used for confirming allergen sensitization. The specificity of the test is based on two radioallergosorbent tests as high as 90% for inhaled allergens. It is essential to obtain proper history, related to allergy and clinical examination should be done using various confirmatory tests. The test ensures that the RAST test is done under the EUCAST protocols and the safest test for allergic reactions.

Acknowledgement : I would like to thank the Department of General Pathology, Saveetha Dental College and Hospitals, Chennai for their valuable inputs in this review.

Conflict of Interest: The authors declared that there is no conflict of interest

Source of Funding : Self

Ethical Clearance: Not required

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