Allergy and Anaphylaxis in Perioperative Period; Recent Advances

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First thanks to **ALLAH** *to whom I relate any success in achieving any work in my life.*

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List of Abbreviations

B W	Body weight
BP	Blood pressure
C	Complement
CT	Computed tomography
ELISA	Enzyme-linked immunosorbent assay
FcεRI	Fc epsilon RI
IgE	Immunoglobulin E
IgG	Immunoglobulin G
IgM	Immunoglobulin M
IL	Interleukin
IM	Intramuscular
IV	Intravenous
LT	Leukotriene
PAF	Platelet activating factor
PGD2	Prostaglandin D2
SC	Subcutaneous
SIRS	Systemic inflammatory immune response

SJS	Stevens-Johnson syndrome
TEN	Toxic epidermal necrolysis
TNF	Tumor necrosis factor
WAO	World allergy organization
WHO	World health organization
µg/L	Microgram per Liter

INTRODUCTION

Anaphylaxis is an acute, potentially lethal, multisystem syndrome resulting from the sudden release of mast cell and basophil-derived mediators into the circulation . It most often results from immunologic reactions to foods, medications, and insect stings, although it can also be induced through non-immunologic mechanisms by any agent (e.g. latex) capable of producing a sudden, systemic degranulation of mast cells or basophils **(Ebo et al., 2008)**.

The term "anaphylaxis" has traditionally been reserved for IgE-dependent events, and the term "anaphylactoid reaction" has been used to describe IgE-independent events, although the two reactions are often clinically indistinguishable **(Gerber and Pichler, 2006).**

Patients undergoing general anesthesia and surgery can experience complex physiologic changes. Recognition of an allergic reaction that occurs during anesthesia is potentially masked by hypotension produced during induction of anesthesia by Propofol or other induction agents, sympathectomy associated with spinal/epidural anesthesia, the inability of the anesthetized patient to communicate early symptoms such as itching, and coverage of the patient by surgical drapes that may obscure detection of cutaneous signs **(Johansson et al., 2010)**.

The most common identifiable causes of perioperative anaphylaxis are neuromuscular-blocking agents (NMBAs), antibiotics, latex, hypnotic induction agents (primarily barbiturates), opioids, and colloids. However, there is a much longer list of agents that are implicated less regularly. In a significant number of cases, no specific trigger can be identified **(Mertes et al., 2008)**.

The safest management approach for a patient with past anaphylaxis is the definitive identification and complete avoidance of the trigger. If this is not possible or evaluation does not reveal a specific culprit, then future management is based upon avoidance of high-risk agents and implementation of general precautions. For patients who require repeat anesthesia, general precautionary measures include optimal preoperative control of asthma, slow administration of antibiotics and other high-risk agents, and avoidance (when possible) of beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, and drugs that cause direct histamine release from mast cells/basophils **(Mertes et al., 2011)**.

AIM OF THE WORK

The aim of this work is to high lighten the perioperative anesthetic management of allergy and anaphylaxis and how to avoid occurance of their complications.

Chapter (1):

PATHOPHYSIOLOGY OF ALLERGY AND ANAPHYLAXIS

Anaphylaxis is an acute, potentially lethal, multisystem syndrome resulting from the sudden release of mast cell- and basophil-derived mediators into the circulation **(Sampson et al., 2006).** It most often results from immunologic reactions to foods, medications and insect stings, although it can also be induced through nonimmunologic mechanisms by any agent capable of producing a sudden, systemic degranulation of mast cells or basophils **(Kemp and Lockey, 2002).**

Terminology:

The term "anaphylaxis" has traditionally been reserved for IgE-dependent events, and the term "anaphylactoid reaction" has been used to describe IgE-independent events, although the two reactions are often clinically indistinguishable. The World Allergy Organization an international umbrella organization representing a large number of regional and national professional societies dedicated to allergy and clinical immunology, has proposed discarding this nomenclature. The WAO categorizes anaphylaxis as either immunologic or nonimmunologic, and

this is the terminology used in this review **(Johansson et al., 2004).**

1-Immunologic anaphylaxis:

IgE-mediated:

The classical mechanism associated with human allergic disease is initiated by an antigen (allergen) interacting with allergen-specific IgE bound to the receptor Fc-epsilon-RI on mast cells and/or basophils. The events leading to allergen-specific IgE production in an atopic individual are complex. In brief B cells are driven to differentiate into IgE-producing cells via the activity of the type 2 subset of CD4-bearing helper T cells. This process largely takes place in the peripheral lymphoid tissues. The cytokines interleukin-4 and its receptors and IL-13 and its receptor contribute to IgE responses in humans. Once produced, allergen-specific IgE diffuses through the tissues and vasculature, and constitutively occupies high-affinity IgE receptors on mast cells and basophils (Figure 1.1).

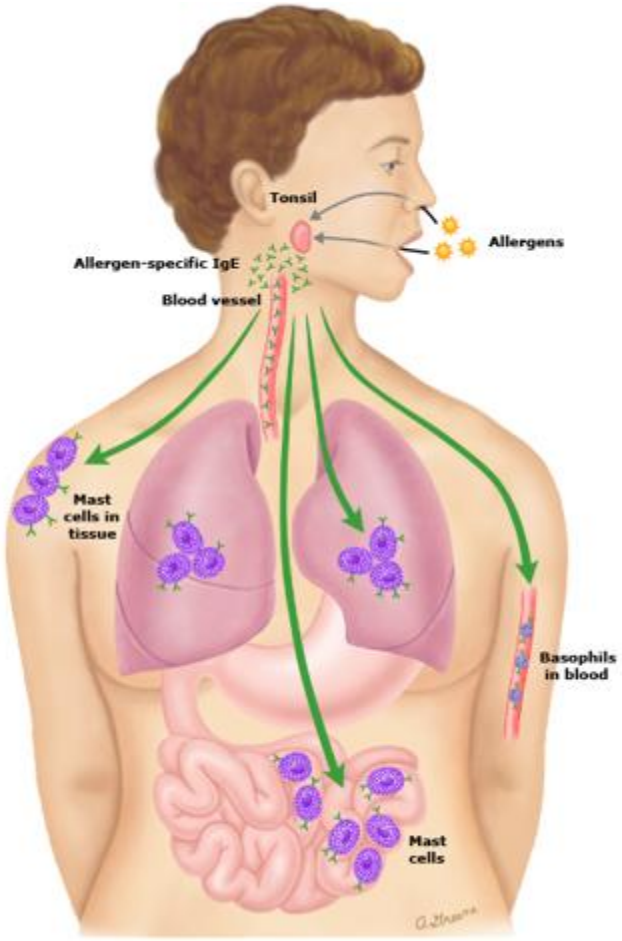

Figure (1.1): Allergen-specific IgE production and dissemination **(Schwartz, 2004)**.

Allergen-specific IgE production and dissemination
IgE: immunoglobulin E.

ROLES OF IgE:

Immunoglobulin E (IgE) is important in defense against parasitic diseases, especially those caused by helminthes and some protozoa. However, due in part to the

redundancy of the immune system, low or absent levels of IgE do not predispose people to severe parasitic infections. IgE is **not** believed to play an important role in defense against bacterial infections, since it does not activate complement or participate in opsonization **(Stone et al., 2010)**.

STRUCTURE:

Immunoglobulin E (IgE) is one of five isotypes of human immunoglobulins, IgG, IgA, IgM, IgD, and IgE **(Schroeder et al., 2010)**. All immunoglobulins are composed of two light chains and two identical heavy chains (figure 1). The heavy chain differentiates the various immunoglobulin isotypes. The heavy chain in IgE is epsilon. IgE is a monomer and consists of four constant regions in contrast to other immunoglobulins that contain only three constant regions. Due to this extra region, the weight of IgE is 190 kDa compared with 150 kDa for IgG. The C-epsilon-2 constant domain is unique to IgE, while the C-epsilon-3 region binds to the low- and high-affinity IgE receptor. Of note, the anti-IgE monoclonal antibody omalizumab also binds to the C-epsilon-3 region, so the binding of omalizumab to IgE decreases the amount of "free" IgE available for binding to IgE receptor-bearing cells, including mast cells and basophils (figure1.2).

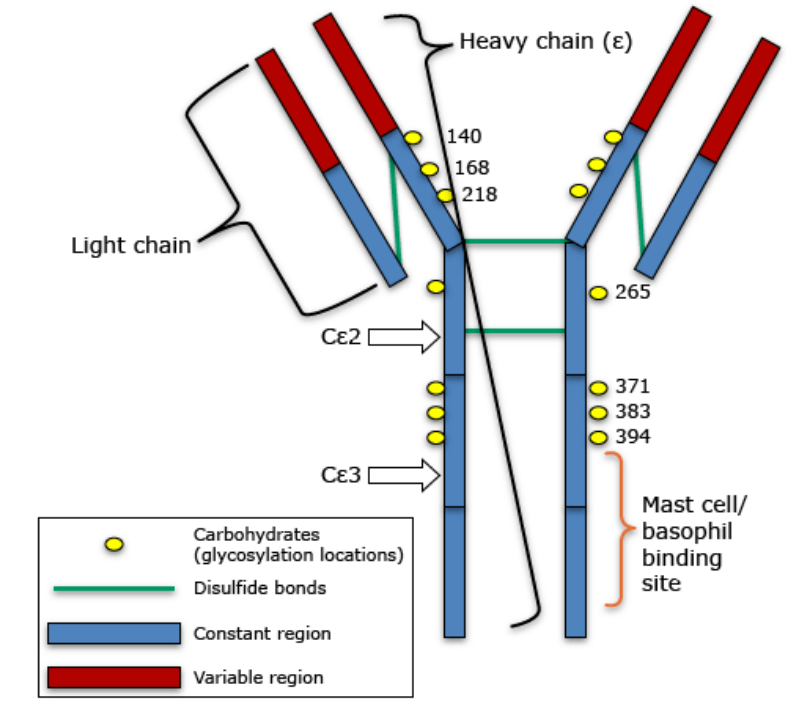

Figure (1.2): Structure of immunoglobulin E (IgE) **(Schroeder et al., 2010; Arnold et al., 2007).**

IgE: immunoglobulin E; ε: epsilon

IgG-mediated:

(in animal models) IgG-dependent anaphylaxis has not been demonstrated in humans. However, human IgG receptors are capable of activating macrophages and neutrophils to secrete Platelet activating factor "PAF" **(Jönsson et al., 2012)**, and PAF can activate mast cells in vitro **(Kajiwara et al., 2010),** so PAF potentially may contribute to human anaphylaxis. Additionally, anaphylaxis