

## LATEX ALLERGY - REVIEW ARTICLE

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One of the nature's gift to mankind is rubber. The usage of rubber and its products are of daily occurrence in modern life. It is not uncommon to have a regular daily exposure to rubber products from birth in all walks of life, since numerous household products, starting from baby bottle nipples, pacifiers, elastic diapers, toys, balls, balloons, band-aids, adhesives (envelope and stamp), art supplies, chewing gum, rubber bands, condoms, rubber buttons on remote controls and calculators, eye pieces on cameras and binoculars, bathmats, shoe soles, and tyres are all made from natural rubber also known as latex. The latex containing products are used extensively in healthcare, such as Gloves, catheters, tourniquets, elastic bandages, IV tubing injection ports, medication vials, band-aids, bulb syringes, tapes, masks, dental dams and stethoscopes. A continuous exposure or contact may sensitize the human body, causing reactions from mild to fatal.

Despite the ubiquitous use of rubber products for many years, it is surprising that latex allergy was described as "an unfamiliar condition." in the medical literature until a decade and a half ago<sup>1</sup>. In the last one decade, there have been increased reports of allergic reactions to latex. The increased awareness in the health care personnel to prevent the transmission of infectious blood borne pathogens has led to frequent use of medical gloves among the health workers. The increased awareness and usage, improved methods in diagnosing latex allergy, has been the reason for the rise in the number of reported cases. This has led to recognition of latex allergy as a serious medical concern.

The earliest recognition of latex allergy occurred in children's hospitals. The high incidence of 73% reported<sup>2,3</sup> in children by Pediatric anesthesiologists has been attributed to repeated exposure, atopy or genetic predisposition<sup>4,5</sup>, particularly in patients with spina bifida and related pathologies. However the incidence of latex allergy in the general population has been estimated between 1% and 6%. The incidence in healthcare workers with regular exposure to latex-containing devices and products ranges from 8% to 17%. Among the healthcare workers anesthesiologists seem to be at more risk for exposure<sup>6</sup>. Although the incidence of anaesthesiologists sensitized to latex is about 12.5percent, about 2.4 percent need treatment<sup>6</sup>.

There are two types of rubber available for regular use in daily life-  
**Natural and Synthetic.**

**Natural Rubber:** The natural latex, named as rubber by Joseph Priestly, since it could be used to rub away pencil marks, is a secretion from the plant. There are over 200 plant species, capable of producing latex. The commercially available

latex is collected from the shaven *Hevea braziliensis* tree bark, as a milky, viscous liquid. This liquid is treated with chemicals soon after collection, to prevent it from hardening into gum. The rubber (latex) is then mixed with sulphur and heated on fire - a process called vulcanization discovered by Charles Goodyear. Vulcanized rubber is stronger, more elastic and stretchable, because of the polymer chains. The polymer snaps back after stretch, returning the product to its original shape. The sulphur cross-links the polymer chains in the latex. A polymer is a long molecule composed of many replicating smaller molecular units. The basic unit of the polymer is called isoprene. Latex is a natural polymer, while different chemicals are used for creating the polymer in synthetic rubbers.

The surgical glove made from natural latex, requires water, vulcanizing agents, accelerators, activators, blockers, retarders, anti-oxidants, preservatives, odorants, colorants, stabilizers, and processing aids in addition to latex for its manufacturing. It is not surprising that the human immune system may sometimes, react to these foreign particles.

Accelerators are chemicals such as thiurams, mercaptobenzothiazoles and carbamates, which are soluble within the natural rubber and speed the cross-linking process, either by donating sulphur atoms or by helping to draw the sulphur into the rubber by binding with sulphur. All of these can cause type IV allergy.

A second group of chemical sensitizers such as substituted phenols are used as the anti-oxidants. These help to decrease the rate of rubber degradation. In spite of the use of accelerators, catalysts and chemical sensitizers Sulphur still remains the primary vulcanizing agent. During the industrial processes of vulcanisation proteins may be altered, and at least one allergen has been found in latex gloves that was not present in rubber sap.

A rubber glove, in addition to natural latex, contains numerous chemicals and cornstarch powder. The normal source material for medical-use latex goods is ammoniated latex, and the processes used include heating to 130<sup>o</sup> C for 30 minutes in the final phase of glove manufacture. Changes in allergen structure may occur over a period after manufacture, as slow chemical changes take place in the matrix of the latex products. Low levels of ammonia contamination in the latex may be responsible for some of these changes, though they are not well documented.

The donning of the gloves is facilitated by use of cornstarch powder. The allergens can leach out from the finished product into the corn starch powder present in medical-use gloves. The cornstarch powder, binds the latex protein, and allows the antigen (in the presence of moisture) to reach both the wearer's and the patient's skin more easily<sup>7,8</sup>. In addition the body sweat inside latex gloves may make latex proteins soluble, allowing absorption through skin and sensitizing the wearer<sup>8</sup>. The amount of free latex protein that can be extracted from powdered latex gloves is consistently higher than the amount that is liberated from non-powdered gloves<sup>8,9</sup>. Further the cornstarch powder becomes airborne easily while donning and removing the glove (aeroallergen), sensitizing health care workers via inhalation. The concentrations of latex aeroallergen vary

from 10 to 208 ng/m<sup>3</sup> with the use of powdered latex gloves compared to 0.3 to 1.8 ng/m<sup>3</sup> when they are never or seldom used<sup>10</sup>. Hence the suggestion that the use of cornstarch powder in latex gloves should not be allowed<sup>11</sup>.

The protein content in the natural product latex varies with each batch. The milky cytosol produced by lactifer cells in the tree contains lipids, phospholipids and over 240 proteins. About 25% of the naturally produced latex proteins can cause immunoglobulin E (IgE)-mediated allergic reactions<sup>12</sup>. The soluble proteins with low molecular weight of around 14600 are thought to be responsible for the allergic response. The greatest proportion of these soluble proteins is found in very soft "dipped" products.

There are significant differences, between the manufacturers in the number and types of chemicals used in production, the time period required to soak to leach out the protein and chemicals after production and the amount of free latex protein that can be liberated from the glove. Thus the final product differs in its contents, having different chemicals in variable concentrations. Hence some brands of gloves are more allergenic than others<sup>13</sup>. It is often thought that products manufactured from **Hypoallergenic Rubber** produce less reaction to the human body. Unfortunately, no such rubber can be manufactured since there is no established safe level for latex protein or glove chemicals which might not be harmful.

**Synthetic Rubbers:** There are different types of synthetic rubbers manufactured, whose properties depend on the chemical used, to form the final polymer. The chemicals used differ between the manufactures, though styrene and butadiene, found in petroleum are the most common chemicals.

### **Types of Allergy**

Allergy to Natural Rubber Latex is an immunologic reaction that can be classified into three types of allergic responses.

1. **Irritant dermatitis**- a skin irritation that does not involve the body's immune response. Although it is not an allergic reaction, irritant hand dermatitis can cause breaks in the skin allowing easier entry of the sensitizing latex protein or glove chemicals, leading to latex allergy.
2. **Delayed cutaneous hypersensitivity** (type IV allergy) is a contact dermatitis due to the chemicals used in latex glove mediated via T-cells. The skin reaction is seen 6-48 hours after contact. The reaction is limited to the local area of skin that has contacted the glove. This is not life threatening but those with type IV allergy will be at increased risk to develop type I allergy.
3. **Immediate reaction (type I allergy)** - These are systemic allergic reactions caused by circulating IgE antibodies to the proteins in natural latex. The reactions vary from contact urticaria to systemic anaphylaxis and laryngeal edema. On the skin this can present as hives that migrate beyond the point of contact with latex. Systemic allergic symptoms can include itching eyes, swelling of lips or tongue, breathlessness, dizziness, abdominal pain, nausea, hypotension, shock and potentially death. Symptoms occur soon after exposure to latex (within about 30 minutes). These symptoms are likely to

result from a massive release of histamine at a local or whole body level. This results from binding of the latex allergen to sensitised receptors on mast cells. The routes of exposure are cutaneous, mucosal, parenteral, and aerosol (from inhaling latex glove powder).

No immunotherapy or desensitization currently exists for latex allergy. Each systemic reaction occurs with less provocation and presentation of a greater magnitude. Unlike natural latex, synthetic rubber does not produce type I allergy (anaphylaxis). Hence these gloves are preferred in people with known type I hypersensitivity or type IV allergy (contact dermatitis). However, it is not impossible to have a serious type IV allergic reaction to a synthetic rubber. Synthetic rubber used in latex paint and rubber-stopped vials, are not a risk to latex-sensitive individuals

### **Populations at Risk**

People working in the rubber industry, health care, multiple hospitalizations with repeated exposure to latex medical products through various diagnostic and therapeutic procedures (eg. spina bifida), are at increased risk for latex allergy. People with asthma or other allergies (Atopic individuals) are at greater risk than the general population. About 25-30% of atopic health care workers may become sensitized<sup>14</sup>. Healthcare providers or others with history of mild latex glove eczema rarely have anaphylactic events. However, a history of severe or worsening latex glove induced eczema, urticaria, or work-related conjunctivitis, rhinitis, asthma, or urticaria may indicate allergic sensitization and increase the risk for more severe reactions with repeated exposure. The people working in the operating room may have a higher incidence of latex sensitization than other hospital personnel. A 1998 study of a large university anesthesiology department found a 12.5% prevalence of latex allergy among its personnel<sup>15</sup>.

Patients with no recognized risk factor can still have allergy to latex. A study of 1000 volunteer blood donors found a 6.4% prevalence of anti-latex IgE antibody<sup>16</sup>. Though the clinical relevance of this finding is unclear, symptomatic reactions have been reported in the absence of known risk factors. It is not uncommon for people allergic to particular foods, to develop a cross allergy to latex. Food allergies to Bananas, Avocados, chestnuts and kiwifruit are associated with latex allergy. An allergy to different foods could occur at any time. Studies have shown a correlation between food allergies and latex allergy. It is important to inform the doctor of food allergy.

### **Preventive measures**

Surgical gloves made from natural latex provide excellent barrier protection and comfort. An ideal latex glove, should be powder free, very low in extractable latex protein, and have the smallest concentration and the fewest number of residual chemicals from manufacture<sup>17,18</sup>. The proper choice of glove appropriate to the situation may be one of the preventive measures to lessen the allergic reaction. The use of non-latex gloves (such as vinyl) when the superior barrier protection of natural latex is not needed such as, a very short (less than 10-15

minute) procedure with minimal prospect for blood or body fluid contact, preparation of the surgical site with an intact patient's skin prior to the start of surgery, making body fluid contact highly unlikely. An important and essential precaution to be followed is, preventing the storage under conditions of excess heat or light, or near the sources of ionizing radiation. This will hasten rapid rubber degradation<sup>19</sup>.

The other preventive measures are prompt removal of gloves after completion of the procedure by the health care workers, washing of hands after glove use to minimize skin contact time with potential allergens, avoidance of touching the eyes, noses, or mouths while wearing or immediately upon removing a latex glove. These measures help to avoid potential sensitization via mucosal routes. Alternately, one should consider the use of surgical glove made from a synthetic rubber. The non latex synthetic rubber gloves differ from the natural latex glove in many ways. The barrier properties of are not clearly defined, while the cost of the synthetics is greater. The comfort, dexterity, and grip of the natural rubber latex glove cannot be compared with Synthetic rubber gloves because the fit, feel, and elasticity of the synthetic materials differ. It is advisable to pay attention to the chemical composition of the glove by the user, because dangerous type IV reactions can be possible.

Use of nonlatex gloves should be the standard, though substitute gloves, such as Vinyl gloves, have also been recommended. Vinyl gloves have been shown to have a higher viral leakage rate than latex gloves<sup>20,21,22</sup>. In the absence of non-latex gloves, the powder-free latex gloves should be preferred. This reduces the airborne latex allergens that can adsorb onto the glove powder. "Hypoallergenic" latex gloves should not be used on patients at-risk or by latex-sensitized health care providers. The "hypoallergenic gloves" contain latex proteins responsible for severe life-threatening allergic reactions

When considering glove selection, although synthetic gloves are more expensive, the cost should not be a measure, compared to the risk of serious allergic reactions in patients who are already sensitized to latex. The cost for replacement of torn gloves and waste removal, to the hospital budget should be weighed against the costs of providing synthetic gloves for workers who become sensitized to latex or the major costs of compensation payments for disability<sup>23,24,25</sup>.

### **Perioperative management**

Although pediatric anesthesiologists were the earliest to recognize latex allergy in children and reported high incidence of 73%<sup>2,3</sup>, latex allergy is not uncommon in adults. The fact that repeated exposure has contributed to in children, should ring a bell to implement precautionary measures to prevent the latex exposure in patients susceptible or at risk. Hence a thorough pre anaesthetic check up is mandatory.

**Pre Anaesthetic Check:** The Food and Drug Administration and the American Academy of Allergy and Immunology have recommended that a detailed preoperative latex-directed patient history is the primary method of identifying these patients. Though history is important and sensitive means, of detecting

individuals at risk, a recent study showed history alone is unreliable in predicting the presence of anti-latex (IgE) antibodies<sup>26</sup>.

**Laboratory test:** The laboratory tests to detect the presence of latex-specific IgE antibodies in both blood and skin testing are essential. Skin prick testing is preferred to intradermal skin testing since there is a greater risk of systemic anaphylactoid reaction, as the antigen can not be wiped from the skin. It is preferable to do skin testing in a well equipped center by a qualified experienced specialist. The latex extract for skin prick testing is being standardized to improve test sensitivity. The problem with skin prick testing is that testing has to be performed with the allergen against which the patient is allergic. There are different types of allergen extracts available, some which may not contain the particular allergen. Extracts of offending material may be made, for instance from gloves. The in vitro tests are safer. In vitro immunoassays are designed to measure IgE anti-latex antibody in serum. In these, a blood sample is taken from the patient and tested for the presence of IgE antibodies specific to latex.

It has been shown that processes which link allergen proteins using amino groups give very good results, compared with skin prick testing. In one study, of 52 skin-prick latex positive patients, 50 were positive by blood tests. The excellent results now possible from blood tests, combined with freedom from danger of immediate hypersensitivity associated with skin prick testing and low cost makes them the method of choice, despite the differences between manufacturers in kit quality for latex.

There are a number of tests from different manufacturers, with different latex extracts. The currently available serum assay methods include the enzyme-linked immunosorbent assay (ELISA) and the radioallergosorbent test (RAST). The RAST has a 53% sensitivity compared to skin tests<sup>27</sup>. Studies which have used immunoassays to detect latex-specific IgE have been reviewed critically<sup>28</sup>. Skin and serological testing have been compared directly, and either of them may be used as a reliable method of diagnosing latex allergy<sup>29</sup>. A negative latex-specific IgE skin or blood test does not rule out absence of latex allergy. The clinical reactions to latex exposure cannot be predicted by either the skin or blood testing. The safest method is to have latex precautions for all individuals with a positive skin test, a positive blood test or a positive history. A complete and thorough medical history remains the most reliable screening test to predict the likelihood of an anaphylactic reaction.

**Premedication:** There is controversy regarding the efficacy of premedication agents to treat patients with confirmed latex allergy. It is thought that since latex allergy is an immune mediated response, antihistamines and histamine antagonists and/or corticosteroids may be administered along with other regular premedication drugs. Despite this suggestion being a success in adults with allergies to radiocontrast media, it has not been so in children since the timing and efficacy of premedication are not well established. The most recent studies suggest that premedication is neither necessary nor effective<sup>30</sup>. Patients have had latex reactions despite such prophylaxis. Individual consideration for each patient with known latex allergy undergoing elective operation or diagnostic and therapeutic procedures should be initiated. It should also be emphasized that

premedication is not a substitute and precautionary measures must be practiced to minimize direct patient exposure to latex.

### PRECAUTIONS

It is rather impossible to eliminate all latex from the operating room or hospital environment or patient exposure. It is not known what constitutes "significant" exposure to latex and the definitive measures that need to be taken. However the precautions and preventive measures begin by avoiding the materials known to have latex, in patients with or at risk for latex allergy.

The following table lists some of the nonanaesthetic and anaesthetic devices used in Perioperative Areas containing Latex<sup>31</sup>.

#### Non Anaesthetic

Urinary catheters and drainage systems	IV solutions and tubing systems	Eyeshields
Wound drains	Fluid circulating thermal blanket	Ambu (bag-valve) masks
Stomach and intestinal tubes	Electrode pads for ECG, peripheral nerve stimulator, contact pads	Medication syringes
Enema tubing kits	Mattresses on stretchers	multi-dose Medication vial stoppers
Protective sheets	Rubber gloves	Stethoscope tubing
Chest tubes and drainage systems	Bulb syringes	Band-Aids™ and other similar bandage products
Condom urinary collection devices	Elastic bandages, wraps	Dental dams
Surgical drapes	Gloves -- examination and sterile	Adhesive tape (porous)
Instrument pads	Hemodialysis equipment	Tourniquets and esmarch bandages

#### Anesthesia Equipment and Products

Blood pressure cuffs (inner bladder, and tubing)	Breathing circuits containing rubber	Certain epidural catheter injection adapters
Head straps	Reservoir breathing bags,	disposable oxygen masks, nasal cannulae
Teeth guards, eyeshields, bite blocks	Rubber ventilator hoses and bellows	Rubber suction catheters, specimen traps
Rubber, oral, nasal; pharyngeal airways	Rubber endotracheal tubes	Patient controlled analgesia syringes
Rubber masks	Latex cuffs on plastic endotracheal tubes	IV solutions and tubing systems (injections ports)
	Latex injection ports on intravenous tubing, stopcocks	

{The list of latex free products for anaesthesia equipment can be obtained from the website of <http://www.hudsonrci.com> and for non anaesthetic products from <http://www.kendalhq.com>}

Birmingham, Dsida and colleagues at Children's Memorial Hospital in Chicago studied 386 myelodysplasia patients undergoing 1025 anaesthetics over a 36-month period and provided some precautionary measures to be observed in patients with known latex allergy such as- Use of nonlatex gloves by surgical,

anaesthesia, and nursing personnel, use of plastic anaesthesia face mask for preoxygenation and positive-pressure ventilation and avoidance of any known latex product in the sterile field by the surgeon. These measures resulted in a statistically and clinically significant reduction in both the overall number and severity of allergic reactions. They also conceptualized that if further measures as: (a) Scheduling elective procedures as the first case of the day (b) Minimizing exposure to aerosolized allergen from latex gloves or products used in preceding cases. (c) Use of Standard polypropylene syringes with a rubber-tipped piston (d) Use of medications from rubber-capped vials, without the need to remove the rubber cap before drawing up the medication. These probably would have resulted in further reduction in both the overall number and severity of allergic reactions<sup>32</sup>.

A second study using almost identical latex avoidance measures audited 162 patients with latex allergy established by history and/or allergy testing who underwent 267 anesthetics<sup>33</sup>. Eighty-six percent of the patients had myelodysplasia, and 13% had bladder or cloacal extrophy. None of the patients received premedication for allergy prophylaxis. The only allergic reaction reported was wheezing, hypotension and urticaria attributed to an epidural injection of bupivacaine and fentanyl drawn up and stored for 1.5 weeks in a syringe with a latex-tipped plunger. The study's author recommends checking syringe plungers and reconstituting medications every six hours. However they do not suggest use of syringes with a non-latex plunger. It was recommended in this study that rubber stoppers be removed from multidose vials. One study found latex allergenic proteins in the solution of a multi-dose vial with a latex stopper after 40 punctures of the stopper<sup>34</sup>. However another study of highly latex-allergic patients examined the reaction to skin injections of extracts of a solution stored in syringes with latex plungers<sup>35</sup>. Only 1 of the 39 latex allergic patients showed any reaction to the injection, and the authors concluded the risk of an immediate hypersensitivity reaction would be very unlikely even in this high risk population. Synthetic butyl rubber stoppers in multi-dose vials, are not a hazard to patients with latex sensitivity.

**Some of the precautionary measures recommended by AANA Latex Protocol<sup>31</sup> for Patient Care in the operating room are:** Patients at risk for latex allergy should have a prominently displayed easy-to-read sign on both their bed and chart indicating that latex precautions be taken. It is recommended that allergic patients should wear a medical alert bracelet to indicate allergy. They should be scheduled as the first case in the morning, with clear and readily visible signs placed on the doors of the operating room to inform all, that the patient has a latex allergy.

### **In The Operating Room**

All the latex products should be removed from the operating room, while the transportation of patient should be on a *latex-free* cart (if available). The protocol recommends the use of *latex-free* reservoir bag, airways, endotracheal tubes, laryngeal mask airways, *non-latex* breathing circuit with plastic mask and bag.

The ventilator should have a *non-latex* bellows. Manufacturers of the commonly used anesthesia machines in the United States now have ventilator hoses and bellows made of neoprene or other non-latex material. This is a standard component in some of the machines, but can be requested with some. If a certain non-latex piece of equipment is not available, the latex counterpart should at least be thoroughly rinsed (e.g. reservoir bag or mask) or covered with tape or cotton gauze. Latex components of the anesthesia machine that are not in close contact with the patient may pose minimal risk of an allergic reaction.

All monitoring devices, cords/tubes (oximeter, blood pressure, electrocardiograph wires) should be placed in stockinet and secured with tape to prevent direct skin contact. The items that have been sterilized in ethylene oxide must be rinsed before use. Residual ethylene oxide can cause an allergic response in a latex-allergic patient<sup>36</sup>.

**Intravenous Line Preparation** : Intravenous tubing with non-latex injection ports and diaphragms is now available. In case of non availability of IV tubing without latex ports, the use of stopcocks if available or coverage of the latex ports with tape should be an alternative. All the rubber injection ports on IV bags are to be covered with tape and labelled with warning instruction “**not to inject or withdraw fluid through the latex port**”. Pulmonary artery catheters (especially the balloon), central venous catheters, and arterial lines may all contain latex components! Medication should be drawn and administered in glass syringes, or plastic syringes with a non-latex plunger which are now available at same prices as of standard latex-tipped syringes.

### **Patient Care In the Operating Room**

The precautionary measures to be followed are to be made aware of to all personnel working in and outside of the operating room. It is preferable to use non-latex examination and surgical gloves. (Use caution when selecting non-latex gloves. Not all substitutes are equally impermeable to blood borne pathogens; care and investigation should be taken in the selection of substitute gloves). The use of non-latex tourniquets and polyvinyl chloride tubing are to be made aware of to all. The medication is to be drawn directly from opened multidose vials (remove stoppers) if medications are not available in ampoules. Stoppers made of synthetic butyl rubber, is not a hazard to patients with latex sensitivity. The medications are to be drawn up immediately prior to the beginning of the case or their administration. The rubber allergen could leach out of the plunger of the syringe causing a reaction. The intensity of this reaction appears to increase over time. It is preferable to use *latex-free* or glass syringes and stopcocks to inject drugs rather than latex ports. It is advisable to minimize mixing/agitating lyophilized drugs in multidose vials with rubber stoppers. It is important to notify Pharmacy and Central Supply that the patient is latex sensitive so that these departments use appropriate procedure while preparing preparations and instruments for the patient. Also notify radiology, respiratory therapy, housekeeping, food service and post operative care units so the appropriate precautions can be made to protect the patient. Even food handled by cafeteria staff wearing latex gloves has been reported to cause a reaction in a

latex-allergic patient. Hence it is strongly emphasized that latex avoidance in patients at-risk must be a hospital-wide policy.

### Signs and Symptoms of Allergic Reactions to Latex

The onset of an allergic reaction after latex exposure can be delayed up to 20 minutes or longer. The intra operative anaphylaxis reaction occurs after 20-30 min after incision and exposure of mucosal surface (peritoneum) to latex gloves of the surgeon. Signs of allergic reaction usually occur within 30 minutes following anesthesia induction; however, the actual onset can range from 10-290 minutes. There may be a fall in saturation and ETCO<sub>2</sub>. The following are the signs and symptoms in anaesthetized and awake patients<sup>31</sup>.

#### Signs

Anesthetized Patient	
Tachycardia	Flushing
Hypotension	Facial edema
Wheezing	Laryngeal edema
Brochospasm	Urticaria
Cardiorespiratory arrest	

#### Signs and symptoms

Awake Patient	
Itchy eyes	Unexplained restlessness and crying
Generalized pruritus	Agitation
Shortness of breath	Nausea
Feeling of faintness	Vomiting
Feeling of impending doom	Abdominal cramping
Wheezing	Diarrhea

Symptoms consistent with a latex allergic reaction, such as wheezing, elevated peak airway pressures, arterial desaturation or systemic hypotension, may result from other allergic or non-allergic etiologies. While latex allergy has been shown to be the main cause of perioperative anaphylactic reactions in children, other causes must also be considered in the differential diagnosis<sup>37</sup>.

### TREATMENT

The primary measure is to identify the source of latex in direct contact with the patient and to remove immediately. Ventilation with 100% oxygen, maintenance of the airway and discontinuation of the Anaesthetic agents (because of hypotension) are of prime importance.

If the reaction is life-threatening, the treatment is similar to anaphylaxis caused by other antigens. Epinephrine is the drug of choice. The dose of epinephrine depends on the severity of symptoms. An initial epinephrine dose of 0.1 mg/kg has been recommended but generally the initial intravenous dose is much less than the recommended resuscitation dose of 10 µg/kg, in order to prevent unwanted hypertension or arrhythmias. Additional administration of the same or escalating doses, and/or use of a continuous infusion may also be

needed. Birmingham, Dsida et al reported that 7 of 14 severe reactions needed Epinephrine<sup>30</sup>.

If the intravenous route is available, it is preferable to subcutaneous or endotracheal administration. If the absence of an intravenous access, epinephrine can be given subcutaneously in doses larger than would be administered intravenously (10 µg/kg dose) or through Endotracheal route. The other important pharmacological measures to be undertaken are the use of Hydrocortisone 0.25 to 1 g or methylprednisolone 1 mg/kg IV;. Diphenhydramine 0.5 to 1 mg/kg (maximum dose 50 mg); Epinephrine infusion (2 to 4 µg/min or more) titrated to effect; Aminophylline (5 to 6 mg/kg over 20 minutes for persistent bronchospasm); and occasionally other inotropes in addition to epinephrine. The other agents that may be used are Ranitidine 0.5 to 2 mg/kg IV (maximum dose 150 mg). Sodium Bicarbonate (0.5 to 1 mEq/kg for persistent hypotension with acidosis diagnosed with laboratory confirmation).

The supportive measures include intravascular crystalloid fluid administration with Ringer's lactate or normal saline, (10 to 50 mL/kg if hypotension is present in patients with no history of congestive heart failure or volume related contraindication). It should not be forgotten to inform the surgical team to stop/abort procedure. Repeated assessment and maintenance of ABCs of resuscitation is essential. Maintenance of airway with a delayed extubation and postoperative ventilation may be required in massive angioedema involving the face and airway.

The Non-Pharmacological Considerations should include sending the blood sample for IgE RAST testing and tryptase level (one-hour postreaction). The incident is to be reported to appropriate institutional entities (i.e; pharmacy, therapeutics, UR, QOC, etc.) The event is to be documented thoroughly and succinctly for morbidity and mortality review at a later date. It may be prudent to have allergy and/or pulmonary consultation as indicated.

Post reaction stabilization and monitoring is equally important and should be in intensive or special care area by dedicated providers well-versed in managing post anaphylaxis patients.

## **SUMMARY**

In the last decade and a half, after the early case reports of latex allergy, much has been learned in a short time. The potential high-risk groups such as children with spina bifida and also operating room personnel have been identified. A well directed patient history, supplemented by skin prick or serum tests for latex antibody will identify most individuals at risk. Relatively simple latex avoidance measures, use of non-latex gloves, will reduce the likelihood and severity of a reaction.

Pediatricians and anesthesiologists need to be educated so that they can contribute to prevent later development of latex allergy in previously unsensitized patients in high-risk groups such as those with spina bifida or bladder extrophy. This can be accomplished by instituting latex precautions from birth onward in these patients by avoiding intense exposure to latex allergen during diagnostic, therapeutic and operative procedures where mucous membrane integrity is

violated, tissue barriers are destroyed, and blood and secretions provide an environment for absorption of latex allergen in large amounts.

Vigilance on the part of all operating room personnel and hospital workers is not to be taken in a lighter vein as it is important in making the hospital environment safe for care of patients predisposed to latex allergy. It cannot be further re-emphasized that latex avoidance in at-risk patients must be a hospital-wide policy.

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