Latex Allergy: Implications for Health Care Workers and Health Care Consumers

Flight Lieutenant Kelly Trudgen
Nursing Officer
Canberra Area Medical Unit

Introduction

Latex allergy has become a serious medical problem for an increasing number of the population. With the number of people reporting a sensitivity increasing dramatically over the past ten years, steps need to be taken to provide a safe environment for both patients and staff. World wide 15 billion pairs of rubber gloves are purchased and used annually (Sansom, 1998) and as a large percentage is also powdered, we are continually exposing ourselves to the latex allergen and increasing our chances of sensitization.

What is Latex?

Latex is the sap of the commercial rubber tree, *Hevea Brasiliensis*. Latex is widely used as it possesses a variety of desirable qualities including strength, flexibility, tear resistance, the ability to self-seal small punctures and barrier integrity (Evangelisto, 1997).

The cloudy white liquid latex is collected 'tapping' the tree. It then undergoes a complex coagulation process involving the addition of sulphur and organic chemicals e.g. accelerators. This process provides the strength, elasticity and dimensional stability characteristic of many rubber products, which make it ideally suited for use in the health care setting. Therefore natural rubber latex is composed of natural proteins and added chemicals, some of which will be removed during washing procedures conducted during the latter stages of production.

There are approximately 240 proteins identified in latex and at least 10 of these proteins have been implicated as allergens with regards to latex allergy (Evangelisto, 1997). With repeated exposure to latex allergens, as with any other allergen, the allergy may worsen to the point of becoming life threatening (Reese, 2001).

Why is this happening?

The use of rubber gloves for surgical procedures was introduced in medicine more than 100 years ago. The first report of an immediate hypersensitivity reaction to natural rubber latex was published in 1979 (Nutter, 1979), however there were early documentations of latex sensitivity as early as 1927 and 1939 (Weido & Sim, 1990).

In response to the increase of infectious diseases, particularly human immunodeficiency virus and hepatitis, the Centres for Disease Control and Prevention in 1987 mandated the use of personal protective equipment where personnel were likely to have contact with blood or bodily fluids (Reese, 2001). These guidelines were issued as Universal Precautions and required health care workers to don gloves for a large part of their working day to prevent infection. Glove usage increased by 8 fold in 1 year with an accelerated demand for gloves from the manufacturers.

Many glove manufacturers, inexperienced in the production of latex products for health care use, expanded production rapidly and may have distributed gloves with high levels of latex allergens. Some of these products were not subject to quality assurance procedures appropriate for medical use. The manufacturers may have shortened the washing or leaching procedure which drains away free standing latex proteins, in order to satisfy demands (Evangelisto, 1997). As a measure of the increasing demand, between 1987 and 1989 the Malaysian Rubber Development Board received over 400 applications to form glove companies, where previously only 25 had existed (Medical Devices Agency, 1996).

A Latex Allergy may manifest in several ways

(1) Irritation

This is not a true allergy but rather a non-specific inflammatory skin response to irritants. The irritants may actually be one of the many different compounding chemicals present in the natural latex rubber product, of which there are nearly 200 chemicals identified (Reese, 2001). The most common reaction to latex products is irritant contact dermatitis and presents as a dryness or cracking of the skin with red, itchy areas when exposed to latex products. This tends to be a chronic condition although it improves during periods when the skin is not exposed to latex. This reaction can also be a result of incomplete hand washing/drying, the use of soaps, hand cleansers, sanitizers and glove powder. Hand dermatitis disrupts the skins barrier and may predispose persons to acquiring a latex allergy (Spina & Hal 1999;Steelman, 1995).

(2) Type 4 Hypersensitivity

This is a delayed response that may occur between 6-48 hours after contact with latex. Symptoms include erythema, pruritus, oedema, cracking of the skin, vesicle formation, burning pain and red swollen rashes. This can become a chronic condition with continued exposure and it is the predominant immunological response (82%) to natural rubber latex (Sussman & Beezhold, 1995;Tarlo, 1998).

(3) Type 1 Hypersensitivity

This is an immediate reaction that happens within minutes to 2 hours, depending on the route of absorption and dose of allergen. This reaction is predominantly a response to the natural protein residue found in natural latex rubber. The reactions are immunoglobulin E (IgE) mediated, producing both localized and systemic symptoms (Young *et al*, 1992). The majority of severe reactions to latex have resulted from latex products contacting the mucous membranes of the mouth, vagina, rectum, or urethra. Oral mucosal contact has resulted I a large number of reactions to various products used in dentistry (Steelman, 1995). Signs and symptoms include itching, urticaria, rhinitis, conjunctivitis, coughing, swelling around the mouth/throat, wheezing, tachycardia, hypotension, faintness, loss of consciousness, and anaphylaxis (cardiopulmonary arrest)(Spina & Hal, 1999;Steelman, 1995).

Routes of exposure

- Direct contact with a range of medical or non-medical latex containing products;
- Inhalation of airborne latex proteins;
- Exposure of mucosal or serosal surfaces to medical products such as rubber catheters or gloves;

Although the amount of exposure needed to cause sensitization or symptoms is not known, studies indicate that the higher the overall exposure in a population, the greater the likelihood that more individuals will become sensitized. Reductions in exposure to latex proteins have been reported to be associated with decreased sensitization and symptoms (Brehler *et al*, 1997).

The use of powdered gloves with high residual latex proteins is thought likely to be responsible for the increases in Type 1 allergy to latex (Heese *et al*, 1997). The proteins responsible for latex allergy have been shown to adhere to the powder that is used in some latex gloves. When the powdered gloves are worn, more latex protein comes into contact with the skin. As the gloves are donned or removed, latex proteins adhered to the powder become airborne and they can be inhaled and come into direct contact with the mucosa of the respiratory tract (Evangelisto, 1997). Hands also sweat inside latex gloves, making the latex proteins soluble, especially in powdered gloves. These soluble proteins are easily absorbed through the skin, sensitizing the individual further. Work areas where only powder-free gloves are used show low levels or undetectable airborne levels of allergy causing proteins (Katelaris *et al,* 1998).

Up until 1998, there were 17 deaths due to latex allergy reported to the United States Food and Drug Administration and more than 1100 reported cases of latex induced anaphylaxis. Statistics are not available for Australia.

Other Risk Factors

(1) Atopy

An individual with a predisposition to allergy is thought to have a higher risk of developing a latex allergy (Santos *et al,* 1997; Slater, 1997; Centres for Disease Control and Prevention, 1997). This also includes familial history of asthma, eczema and hayfever. One study has reported that 77% of individuals with latex allergy had a history of an atopic illness (Taylor and Praditsuwan, 1996) whilst another reported that 100% of individuals with positive latex skin tests were atopic to common allergens (Leung, 1998).

(2) Cross Allergies

Natural rubber latex is derived from a plant protein. Cross reactivity with other plants has been reported, including food products (Sussman & Beezhold, 1995). An increasing list of foods includes bananas, avocadoes, kiwi fruit, strawberries, watermelon, chestnuts, peaches, cherries, apricots, apples, plums, tomatoes, potatoes, coconuts, pawpaw and figs.

(3) Multiple Surgical Procedures

Individuals who have undergone multiple surgical procedures are at high risk of sensitization with prevalence possibly as high as 60% due to cumulative exposure to latex products (Reddy, 1998). Intraoperative anaphylaxis without prior evidence has been reported in patients who have undergone multiple surgical procedures (Pasquariello *et al,* 1993). Reported incidences of both intraoperative and post operative complications of latex allergy symptoms have also been recorded in individuals with a history of medical conditions such as asthma, eczema and hayfever (Reese, 2001).

Prevalence of Latex Sensitisation

The prevalence of latex sensitisation and latex allergy varies among populations studied and the methods of testing used. The following have been reported worldwide:

- Australia – 9% prevalence of latex hypersensitivity among dental workers in a Sydney dental school (Katelaris *et al*, 1996)
- Canada – 12.1% prevalence of latex sensitisation among latex glove users in a Canadian hospital (Sussman *et al,* 1998)
- Hong Kong – 6.8% prevalence of skin test positivity to latex extracts among health care workers in a large teaching hospital (Leung, 1998)

- United States – estimated rates of latex allergy of 1% in general population however 5-17% among health care workers.
- US Army Dental facilities worldwide – 8.8% prevalence of latex allergy in dental workers

General research studies show a prevalence of 8-30% among health care workers worldwide. Nurses as a subgroup have a prevalence between 9-17.6%, averaging 1 in 10 (Senst *et al,* 1997;Hunt *et al,* 1995;Watts *et al,* 1998;Sinha *et al,* 1998;Liss *et al,* 1997;Konrad *et al,* 1997) Of 7,400 National Health Service staff, studies showed that 43% had signs or symptoms of Irritant Contact Dermatitis or Type 4 Hypersensitivity, and 10% showed immediate hypersensitivity (Johnson, 1999). Gender is also important, as 75% of individuals with a latex allergy are female (Evangelisto, 1997). Other populations at risk include blood donors, latex industry workers and patients with spina bifida.

Diagnosis

A positive diagnosis for latex allergy is made using the results of a medical history, physical examination, diagnostic/exposure-related evaluation, and tests. The medical history is often the earliest positive diagnosis and is often made late. Many patients may present with symptoms of allergic rhinitis, headaches, dizziness, unexplained syncopal events, late onset asthma and contact dermatitis without correlation to latex exposure. Health care workers may feel well at the beginning of the shift and then deteriorate by the end of the day. This may lead to latex allergy being undiagnosed for years and the individual may be exposed to latex unnecessarily, sensitizing them further.

No single diagnostic test is 100% accurate and there is still no "gold standard" for diagnosing allergy to latex. The most common tests used are a patch test and the skin prick test. RAST testing is also available. Patch testing and skin prick testing are relatively quick, inexpensive and possess higher sensitivity and specificity rates than RAST testing, but they also carry higher risks for potentially serious systemic reactions during testing (Reese, 2001).

Skin prick tests involve scratching or pricking the skin through a drop of latex exudates. Positive reactions are indicated by itchy, reddened or swollen areas and are measured against positive and negative controls. Skin prick testing sensitivity ranges from 74-82%, and specificity ranges from 89-93% (Kim *et al,* 1998;Avila *et al,* 1999). Whilst skin prick testing is more likely to confirm a positive allergy history than RAST testing, in vitro blood testing is a safer method of testing. Unfortunately, in vitro RAST assays are not as accurate with sensitivity ranges from 49-76%, and specificity ranges from 86-97% (Avila *et al,* 1999).

Economic Implications

Latex allergy has significant economic implications through costs for the health care worker, the health care institution and latex manufacturers. The sensitisation of health care workers may incur workers compensation costs and directly affect the health care worker in loss of income or a decreased earning capacity. A latex allergy may necessitate a career modification or change, or even a permanent disability. For the institute, costs may arise from prolonged patient stays and adverse treatment outcomes, medico-legal issues, changes in protocols for the treatment of sensitized individuals and changes required to minimize latex allergy sensitisation and reactions.
The manufacturers incur costs as they try to eliminate the latex proteins from their products through research and development. These costs are often passed on to the consumers (Weinert, 1998).

Strategies for Prevention and Management

To prevent further morbidity and potentially mortality, for health care workers and consumers alike, health care institutions must consider implementing strategies for the prevention and management of latex allergy. In December 2000, the NSW Department of Health published Policy Framework and Guidelines for the Prevention and Management of Latex Allergy. To date, these are the only documented guidelines in Australia, however they follow the same principles that have been introduced in a majority of states in the USA, Canada and the United Kingdom.
The objectives of guidelines to employers should include the following:

- Reduce the incidence of sensitisation to latex and prevent the occurrence of allergic reactions in sensitized individuals
- Provide non-latex gloves to sensitized individuals and those who wish to choose a latex alternative
- Provide powder-free gloves, preferably with low-protein content
- Provide education/training programs and material
- Periodically screen high-risk workers for natural latex rubber allergy symptoms
- Reduce the use of latex glove usage in areas like kitchens and housekeeping

To provide a latex-safe workplace, either low-protein, powder free products or non-latex products should be considered. As gloves are the single major source of latex exposure in the health care setting, this is primarily achieved by glove substitution (Kelly & Walsh-Kelly, 1998;Melton, 1997; Evangelisto, 1998). Suitable substitutes are made of vinyl, nitrile and neoprene. According to some studies these alternatives provide better barrier protection than latex (Thompson, 1998;Clappison, 1998). Most latex sensitized health care workers can stay in the health care profession if exposure is avoided by eliminating powdered latex gloves and supplying latex-free materials (Allmers *et al,* 1998).

Conclusion

Everyday exposure, although cumulative, is not the greatest threat to most latex allergic individuals; rather the health care setting is. Unfortunately for some individuals, diagnosis is often made late as the symptom may present as separate problems. Most individuals innocently undergo medical and surgical procedures, unaware that they may be at risk for sensitisation. With financial, medico-legal, occupational and personal ramifications involving latex allergy, many health care providers are choosing to limit their workplace exposure by going latex free (Cameron, 1997; DeJohn, 1999). The guidelines promulgated by the NSW Department of Health recommend that all NSW public health care facilities eliminate the use of latex by 2003 as far as possible and indeed there will be no latex glove usage in these public facilities from 2003. Prevention is better than the cure and the time to take preventative measures is now.

Annex A

Latex Free List

This is a list of common medical devices and products that contain latex and their alternatives. Currently there is no mandatory labeling with respect to the natural latex rubber content of medical products and the list is based on written information given by manufacturers and distributors.

Latex Containing Products	**Latex Free Alternatives**
Latex gloves	Ansell Dermaprene Baxter Duraprene J&J Allergard Vinyl exam gloves Nitrile exam gloves Neoprene exam gloves
Pulse oximeter probes	Datex Ohmeda
BP cuff leads	Protect limb with clothing or velband Critikon soft cuffs Medtel
ECG dots	3M dots Kendall
Pulmonary artery catheters	No alternatives to date. Risks and benefits assessed on an individual basis.
IV latex bungs	Braun Reflux valves 3 way taps AstroZenica Septodent (alternatively, replace latex bungs prior to running IV fluid through line)
IV line	Braun line with reflux valves Smith & Nephew
Fluid bags	Remove or tape latex port
Colloids – Haemaccel	Albumex 5
IV drugs with stoppers eg Hydrocortisone	Remove all stoppers and mix with mixing cannula
Emergency drugs	IMS minijet drugs
Syringes	Terumo
Resuscitators	Laerdal MR 100 Smith & Nephew
Face masks	King systems Promedica Rusch
Rebreathing bag	Promedica Rusch
Oral airways	Mallinckrodt Rusch Promedica Smith & Nephew Laryngeal mask
Nasopharyngeal airways	Smith & Nephew Rusch
Bite block	Smith & Nephew

ETT	Smith & Nephew Rusch Mallinckrodt Portex
Tracheotomy tube	Smith & Nephew Rusch
Catheter Mount	Mallinckrodt Promedica
Smooth bore tubing	Fisher & Paykel Promedica Bain Circuit
Ventilator Bellows	Ohmeda
Fibre-optic scopes	Olympus Pentax
Urinary catheters	Bard Cook
Tapes	Micropore Transpore 3M Microfoam Steristrips Hypafix (Smith & Nephew) Albupore Tensoplast
Dressings	3M Tegaderm Opsite Airstrip
Drains – Penrose	Jackson Pratt Zimmer
Esmarch bandages	No alternatives – Risks and benefits assessed on an individual basis.
Dilators	
Bulb syringes	
Instrument mats	
Embolectomy catheters	
Intra-aortic balloons	

Examples of Non-Medical Products Containing Latex

Vehicle tyres	Motorcycle and bicycle handgrips
Carpet backing and underlay	Swimming goggles
Racquet handles	Shoe soles
Expandable fabric	Dishwashing gloves
Condoms	Diaphragms
Balloons	Baby bottle teats and dummies
Instant Scratchies	Hot water bottles

References

- Avila,P.C.,Schusterman,D.J.(1999) Work-related asthma and latex allergy. Postgrad Med 1999;105:39-46
- Brehler,R.,Kolling,R.,Webb,M., and Wastell,C. (1997) Glove Powder – A Risk Factor for the Development of Latex Allergy. Eur J Surg (Suppl) 579:23-25
- Allmers,H.,Brehler,R.,Chen,Z.,Raulf-Heimsoth,M.,Fels,H.,Baur,X.(1998) Reduction of latex aeroallergens and latex-specific IgE antibodies in sensitized workers after removal of powdered natural rubber latex gloves in a hospital. J Allergy Clin Immunol 1998;102:841-6
- Cameron,M.(1997) Cost implications of allergy and recent Canadian research findings. Eur J Surg 1997 (Suppl) 579:47-8
- Clappison,R.A. (1997) Changing the Course of latex allergies. Oral Health 1998;June:17
- DeJohn,P. (1999) Latex free means costly:glove buy a balancing act. Hospital Materials Management 1999;24(5):7-9
- Evangelisto, M (1997) Latex Allergy: The Downside of Standard Precautions. Todays Surg Nurse Sep/Oct:28-33
- Evangelisto, M (1998) Making the Choice: Can you go Latex Free? Todays Surg Nurse Jan/Feb:40-4
- Heese,A.,Petere,K.P., and Kock, H.U.(1997) Type 1 Allergies to Latex and the Aeroallergenic Problem. Eur J Surg (Suppl) 579:19-22
- Hunt,L.W.,Fransway,A.F., Reed,C.E.,et al. (1995) An epidemic of occupational allergy to latex involving health care workers. J Emerg Med 1995;37:1204-9
- Katelaris, C.H.,Widmer,R.P. and Lazarus, R.M. (1996) Prevalence of Latex Allergy in a Dental School. Med J Aus;164:711-714
- Katelaris,Cwidmer,J, and Labbet,J.(1998) Guidelines for the Management of Latex Allergic Individuals in Health Care Facilities and for the Minimisation of Continuing Latex Sensitisation. Working Party of the ASCIA June 98
- Kelly,K.J.,Walsh-Kelly,C.M. (1998) Latex allergy: a patient and health care system emergency. Ann Emerg Med 1998;32:723-9
- Kim,K.T.,Safadi,G.S.,Sheik,I.M. (1998) Diagnostic evaluation of type 1 allergy. Ann Allergy Asthma Immunol 1998;80:66-70
- Konrad,C.,Fieber,T.,Gerber,H.,Schnepfer,G.,Muellner,G. (1997) The prevalence of anti-latex IgE antibodies among anesthesia staff. Anesth Analg 1997;84:629-33
- Leung,R (1998) Prevalence of Latex Allergy among hospital staff in Hong Kong; Asian-Pacific Newsletter 1/1998
- Liss,G.M.,Sussman,G.L.,Deal,K.,et al. (1997) Latex Allergy:epidemiological study of 1351 hospital workers. Occup Environ Med 1997;54:335-42
- Melton, A.L. (1997) Managing latex allergy in patients and health care workers. Clevel Clin J Med 1997;642:76-82
- Nutter, A.F. (1979) Contact urticaria to rubber. Br J Derm;101:597-8
- Pasquariello,C.A,Lowe,D.A.,and Schwartz, R.E. (1993) Intraoperative anaphylaxis to latex. Pediatrics;91(5):983-986
- Reese,D.J. (2001) Evidence for Making Military Treatment Facilities Latex Safe. Military Medicine;166(9):764-775
- Sansom, A. (1998) Latex and How It Effects the Hospital. ACORN Journal Summer 1998
- Santos, J.E.,Hernandez-Ayup,S.,Galache,P.,Morales,F.G.,Batiza,V.A., and Montoya,D. (1997) Severe Latex Allergy after a vaginal examination during labour:A Case Report. Amer J Obs&Gynae;177(6):1543-1544
- Senst,B.L.,Johnson,R.A. (1997) Latex Allergy. Am J Health Syst Pharm 1997;54:1071-5
- Sinha,A.,Harrison,P.V. (1998) Latex glove allergy among hospital employees: a study in the north-west of England. Occup Med 1998;48:405-10
- Slater, J.E. (1997) Latex Sensitivity; Resp Care J; 11

- Spina,A.M.,Hal,J.L. (1999) Latex Allergy: A review for the dental professional. Oral Surg Oral Med Oral Path 1999;87:5-11
- Steelman,V.M. (1995) Latex Allergy Precautions:A research based protocol. Nurs Clin North Am;30:475-93
- Sussman, G.L.,Beezhold, A.H. (1995) Allergy to Latex Rubber. Ann Inter Med 1995;122:43-6
- Tarlo, S.M. (1998) Latex Allergy:a problem for both healthcare professionals and patients. Ostomy/Wound Management 1998;44(8):80-8
- Taylor, J.S. and Praditsuwan, P.(1996) Latex Allergy:Review of 44 cases including outcome and frequent association with allergic hand eczema. Archives of Derm;132:265-271
- Thompson, C.A. (1998) Medical devices with latex become easier to identify. Am J Health Syst Pharm 1998;55:2059-73
- Watts,D.N.,Jacobs,R.R.,Forrester,B.,Bartolucci,A. (1998) An evaluation of the prevalence of latex sensitivity among atopic and non-atopic intensive care workers. Am J Ind Med 1998;34:359-63
- Weido, A.J.,Sim,C.T. (1990) The Burgeoning problem of latex sensitivity. Postgrad Med 1990;98:173-84
- Weinert, G. (1998) Latex allergy costs. Surg Services Mananagement Mar;4(3):27-30
- Young, M.,Meyers,M.,McCulloch,L.,Brown,L. (1992) Latex allergy A Guideline for perioperative nurses.AORN Journal Sep;60(5):302-488