

Latex Allergies Uncovered

Latex “Allergy” is often cited as a reason to avoid Latex gloves, despite their excellent comfort and barrier protection. The reality is a little more complex, read why.

Abstract

This article sums up the whole complex issue of latex allergy: from its causes, effects on the human body, how latex proteins can invade the system and, crucially, the difference between high-grade and low-grade materials and the importance of high standards in the manufacturing process.

As attitudes to hygiene, safety and health improve around the world, there is a greater need than ever for quality latex gloves across a host of professions and industries. But as this global demand grows, the issue of latex allergy becomes more important.

The scale of the problem varies significantly. To some there has been an ‘epidemic’ of allergic reactions that throws into question the use of Natural Rubber Latex (NRL) as a material, while others produce low-grade latex gloves on an unprecedented scale, indifferent to the hazards these represent.

There are two ways latex gloves can cause an allergic reaction in humans. While the assumption is that contact with the epidermis, i.e. through wearing latex gloves, is the major reasons for a reaction, in fact there is evidence to show that airborne latex proteins are often the cause.

Free latex proteins on the inner surface of the glove may come into contact with the epidermis, penetrating the skin to the subcutaneous layer where mast cells are to be found. This is particularly so in the case of cheaply-manufactured gloves, which have not been treated properly and therefore contain high levels of residual water soluble protein content. This is generally acknowledged as a free protein content of 50µg per gram of glove material though the regulated level does vary between ASTM or EN standards.

The other main cause of a user coming into contact with latex proteins is when these are adsorbed on to the powder added to the inner surface of a glove by some manufacturers, to act as a lubricant. Once a glove is removed this protein-laden powder becomes airborne and can cause a reaction if inhaled by a sensitized person. This is an important consideration when using powdered latex gloves.

One common factor in the causes of a reaction due to natural rubber latex proteins coming into contact with the skin or by inhalation of the proteins, or a less serious irritation caused by natural rubber latex; is the quality of the glove and the way it is manufactured.

In the highest-standard procedures, glove is washed and treated after manufacture. This washing removes a high proportion of the free latex proteins and also chemically fixes them to

the surface of the glove. Gloves that are properly washed and free of powder expose the user to a far lower level of water soluble protein content and consequently much less likely to develop sensitization or allergy whilst using natural rubber latex gloves.

Introduction

As attitudes to hygiene, safety and health improve around the world, there is a greater need than ever for quality latex gloves across a host of professions and industries. But as this global demand grows, the issue of latex allergy becomes more important.

The scale of the problem varies significantly. To some there has been an 'epidemic' of allergic reactions that throws into question the use of Natural Rubber Latex (NRL) as a material, while others produce low-grade latex gloves on an unprecedented scale, indifferent to the hazards these represent.

Inevitably, one is related to the other. But neither does much to further the debate about the future of latex, and where the balance lies. Here we assess the vexed question of latex allergy, and the ways it can be best countered through quality manufacturing and smart application.

What is latex allergy?

Sufficient exposure to latex proteins through regular contact can cause an enhanced response from the body known as sensitization to occur. This, in turn, can lead to a full-blown allergy.

When sensitization to any protein has taken place, subsequent re-exposure can cause IgE molecules on the surface of mast cells in the epidermis to detect the entry of the foreign substance, sparking the immune system into action.

The first response to a foreign protein – of which natural rubber latex is one – is for the mast cells to send out signals using mediators such as histamines and leukotrienes. These prompt surrounding cells and molecules to amass around the point of invasion and work together to destroy the substance.

This process can take place for a host of reasons, but in the specific case of an allergic reaction, such as is caused by natural rubber latex, it is known as immunological contact urticaria. Its symptoms, caused by an excess of mediators in the body, are most apparent in the form of small swellings on the skin surrounded by red patches with a sore or burning sensation, rhinitis, conjunctivitis or asthma.

Contact urticaria can cause vasodilation (dilation of blood vessels) and, in a case where extremely high levels of mediators are produced leading to anaphylactic shock, smooth-muscle contraction can occur. In the most serious cases this can lead to coronary and respiratory complications, and can be fatal.

Types of reaction

Our interest is in the two types of allergic reaction relevant to occlusive gloves: Type I and Type IV. Either of these can be caused by NRL gloves, though the latter is generally as a result of contact with chemicals used in their manufacture while the former is due to the proteins in rubber itself.

Type I hypersensitivity - or 'immediate hypersensitivity' - manifests itself relatively quickly in the body, typically between three minutes and an hour after contact, ingestion or inhalation of a substance. This is generally the more serious of the two as it is the one that carries the risk of anaphylaxis.

A Type IV reaction happens relatively slowly, between 10-24 hours after exposure, and can carry still be worsening as long as 72 hours afterwards. It is generally caused by chemical additives, known as accelerators, used in the process of manufacturing NLR gloves.

What causes a reaction?

There are two ways latex gloves can cause these reactions. While the assumption is that contact with the epidermis, i.e. through wearing latex gloves, is the major reasons for a reaction, in fact there is evidence to show that airborne latex proteins are often the cause.

Free latex proteins on the inner surface of the glove may come into contact with the epidermis, penetrating the skin to the subcutaneous layer where mast cells are to be found. This is particularly in the case of cheaply-manufactured gloves, which have not been treated properly and therefore contain high levels of residual water soluble proteins. This is widely acknowledged to be defined as a maximum residual content of water soluble proteins of 50µg per gram of glove material.

The other main cause of a user coming into contact with latex proteins is when these are adsorbed on to the absorbable modified corn starch donning powder (of USP grade) added to the inner surface of a glove by some manufacturers, to act as a lubricant when donning the glove. Once a glove is removed this protein-laden powder becomes airborne and can cause a reaction if inhaled by a sensitized person.

Is there an 'epidemic'?

It's important at this stage to note a third complaint associated with using natural latex gloves on a regular basis, and to distinguish this from any of the allergic reactions explained above. Indeed, the most common consequence of long-term use is classed as irritation – a non-allergic reaction caused by a range of factors.

Why is this important? Much of the negative press surrounding the use of NLR in medical or other industrial uses is – in some cases inadvertently – actually referring to irritation or contact dermatitis not caused by the latex itself but by the ways in which it is used in practice.

Contact dermatitis can be caused by a whole range of factors associated with latex glove use: sweating, occlusion from a glove being worn too tightly for too long, contamination of the skin through incorrect use or by chemicals added to the inside of the glove. The symptoms of this type of reaction, while uncomfortable, are not part of the immune responses listed above and are almost always easily-treatable provided that they are dealt with promptly.

As health and safety standards improve throughout the globe and the use of proper gloves in a range of industries thankfully increases, the occurrence of this third type of reaction inevitably becomes greater; so much so that legislation has followed. In Germany, for example, regulations are now in place to ensure that users must take extra precautions when wearing latex gloves for long periods, regardless of sensitization.

The importance of quality

One common factor behind the potential for natural rubber latex gloves to cause irritation, develop sensitization or in extreme cases an allergic reaction, is the quality of the glove and the way it is manufactured.

In the highest-standard procedures, the inner and outer surface of every glove are washed thoroughly. In an online process the inner surface only washed after curing and the inner and outer are ‘washed’ during the manufacturing process. This washing both removes a far higher proportion of the free latex proteins in the glove are removed or fixes them to the glove surface in the process, meaning the user is exposed to fewer proteins. To ensure best practice the Malaysian government prevents the export of gloves containing more than 400µg, a quality manufacturing target is generally less than 100µg per glove.

Conclusion from the NHS

In 2008 a major study was carried out jointly by NHS Plus Occupational Health Clinical Effectiveness Unit and the Royal College of Physicians into the issue of latex allergy management.

Primary to the study’s conclusions was that it was the high level of free proteins adsorbed on to the powder that lined gloves that was responsible for much of the adverse reactions felt by clinical staff and patients in the wards. It recommended that these gloves, and high-protein gloves, should not be used, in order to significantly reduce “the incidence of latex allergy and latex-induced asthma, as well as the prevalence of latex-related symptoms”.

The alternatives to Latex

There are, of course, other options for the materials used in glove manufacture. In their joint report, NHS Plus and the Royal College of Physicians said that “latex avoidance measures” could be sought in some cases of allergy and sensitization.

Latex is ubiquitous not just for its flexibility, stretch and strength, but because it is in the perfect medium of being able to be produced and manufactured to a high standard, on a mass scale.

Manufacturers have struggled to find an alternative material that can suit the needs of growing demand in a global era. Here we identify some of the primary options, with a brief assessment of their practical use and cost effectiveness.

Vinyl (actually Polyvinylchloride)

Actually a combination of PVC and plasticizers needed to give the PVC some elasticity and plasticity. Vinyl offers reduced protection against biological hazards, poor dexterity and tears easily. Cases of both type I and type IV allergic reactions have been reported. Disposal by incineration can release carcinogens (Dioxins). Concerns have been expressed about the toxicity of the phthalates that are often used as plasticisers.

Nitrile

Offers a level of protection approaching that of natural rubber latex until punctured. Since nitrile gloves commonly use many of the chemicals found in natural rubber gloves, cases of type IV reactions are common. At least two cases of type I reactions have been reported. Disposal by incineration can release cyanide.

Neoprene (actually Polychloroprene)

Good level of protection. Tend to tear easily. Expensive. Can become slippery when wet.

Synthetic Polyisoprene

Similar to natural rubber latex, but expensive and not easy to obtain.

Polyurethane

Reasonable level of protection. Strong, but uncomfortable to wear and poor dexterity. Expensive.

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Styrene block copolymers

Poor elasticity, reports of type I allergy, expensive and difficult to obtain, not resistant to many chemicals found in healthcare.

Polyurethane

Reasonable level of protection. Strong, but uncomfortable to wear and poor dexterity. Expensive

Conclusion

Across the myriad of purposes for which latex gloves are useful, the common thread is the need for safety, flexibility and the reduction of adverse reactions to the user.

As multiple studies have shown, poor quality gloves, or gloves which are manufactured with a powder lubricant on the internal wall, greatly enhance the risk of allergic reaction. Through either the high level of free proteins typical in low quality gloves, or because of the added danger of the powder acting as a vehicle for those proteins, they are riskier and should be avoided.

There is no one solution to issue of latex allergy. In some cases, sensitization and allergy are so severe that a user is at risk even from the slightest contact. But as a rule, for users with no allergy or only a mild reaction, quality manufacturing and proper usage shine through.

A glove with a high standard of finishing will not only feel better and be more dependable, but crucially it will be less rife with free latex proteins on the inner surface and therefore much less likely to cause a reaction. A glove without a powder coated lining has been proved time and again to be less harmful to users and, in the case of healthcare, patients, because it eliminates the risk of latex protein inhalation.

As the use of gloves burgeons around the globe, the temptation for manufacturers to cut corners becomes stronger. But as this report shows, for the purchasers and the users, these could well prove to be false economies that do more to endanger the reputation of latex than it could ever do itself.

