



Anaesthesia for the allergic patient

[Review Article]

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Abstract

Knowing that allergic reactions that occur during anaesthesia are essentially caused by muscle relaxants or latex, the patients who should be singled out during the preanaesthetic visit are those already allergic or thought to be allergic to these two substances. On the other hand, atopy or allergy to other drugs, such as antibiotics, has not been proved to favour the triggering of anaphylactic shocks with anaesthetic drugs. Allergy to local anaesthetics is so exceptional that it may be easily dismissed by a challenge test.

Introduction

When questioning patients before anaesthesia about their medical history, allergies of all kinds are found in 15-20% of them. Anaesthetic agents and other drugs used during anaesthesia are themselves responsible for allergic reactions. Are patients with a history of allergy therefore more likely to have an allergic reaction during anaesthesia than those who are not allergic? What can be done to reduce this risk before anaesthesia? For which patients should an allergological assessment be prescribed? How should anaesthesia be carried out for routine and for emergency surgery?

The allergic risk caused by anaesthesia

Large Australian and French epidemiological studies [1,2] have shown that 60-70% of serious anaphylactoid reactions occurring during anaesthesia are of immune origin, i.e. they are caused by specific IgE antibodies. The other reactions are caused by non-specific histamine release, a direct pharmacological effect of the drug involved.

In France, out of 1000 anaphylactic shocks that occurred during anaesthesia in 1992-1994 [2], the drugs responsible were for the most part muscle relaxants (59.2%) (Table 1). Latex came next in frequency (19%), and other drugs were much less involved. Among the muscle relaxants, suxamethonium was responsible for the most shocks (39.3%); vecuronium and atracurium came next, with 36.1 and 14.5%, respectively. These French figures for the 1992-1994 period equated with the market shares for vecuronium and atracurium, but not for suxamethonium, which only represented 5% of the muscle relaxant market [2]. Cross-sensitization between muscle relaxants is seen in up to 70% of patients allergic to one muscle relaxant [2]. This cross-allergy most often occurs between muscle relaxants of the same chemical group [3], but occasionally involves all muscle relaxants. Moreover, anaphylactic shock can occur on the first exposure to a muscle relaxant, which is a rather rare occurrence in other allergic conditions [4•]. This suggests that sensitization is not caused by a muscle relaxant. In fact, the allergenic part of the muscle relaxant molecule is the quaternary ammonium ion. Sensitization is therefore thought to be caused by

repeated contacts with the numerous household agents which have this quaternary ammonium ion [5]. This might explain the high proportion of women who have had a shock reaction to muscle relaxants. Furthermore, the continuously positive results of skin tests may be caused by continuous antigenic stimulation.

Substances	n	%
Muscle relaxants	610	59.2
Latex	185	18.0
Induction agents	83	8.0
Colloid solutions	51	5.0
Narcotics	36	3.5
Local anaesthetics	7	0.7
Other drugs	16	1.5
Total	1030	100.0

Table 1. Substances responsible for 1000 cases of clinical anaphylaxis during anaesthesia in France over 2 years (1992-1994) [2]

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Latex is the second largest cause of anaphylactic shock that occurs during anaesthesia. This was first reported in 1984 by Turjanmaa *et al.* [6]. In France in 1989, latex was thought to be involved in 0.5% of all anaesthetic shock reactions. Since that time, this figure has been rising steadily, reaching 12.6% in 1990-1991 [7] and 19% between 1992 and 1994 [2]. This has given rise to hundreds of papers in the international scientific journals. The risk factors are now well known. At the same time, the numerous allergens of natural latex have been identified, so that diagnostic tests have been developed. Cross-allergies with latex have also been reported. Preventive measures can now be put forward.

Latex shocks that occur during anaesthesia are immediate type I reactions, caused by specific IgE antibodies to one or several of the natural proteins of *Latex hevea brasiliensis*. Of the 200 latex polypeptides, approximately a dozen have been clearly identified and separated [8,9]. This should help in developing specific radioimmunoassays, thus making diagnosis more precise. Several proteins seem to be particularly involved in sensitizing some groups of patients who are at risk [9]. The frequent combination of an allergy to latex proteins and to various fruits (avocado, banana, chestnut, passion fruit, melon, kiwi, papaya, peach and tomato) has increasingly been reported [10]. Brehler *et al.* [11•] have shown that in the serum of 69% of 136 patients who were allergic to latex, there were fruit-specific IgE antibodies. These recognized both latex and fruit allergens. There is therefore cross-sensitivity, with clinically significant effects in 30% of cases. Similarly, grass pollen has the same IgE epitope as latex [12•]. The presence of common epitopes might partly explain the clinical symptoms seen when patients who are allergic to pollen, i.e. atopic patients, or those allergic to fruit are exposed to latex.

Allergic history and risk of anaesthetic anaphylaxis

For most people, allergy can mean either a true allergic reaction or various upsets. During the preanaesthetic visit, the history should be detailed (see Appendix 1), so as to determine the difference between these kinds of reactions, as the ensuing risks will differ. Atopy, drug allergy, allergy to latex and to tropical fruit should be ascertained.

Atopy

This is a hereditary predisposition, in which the patient will synthesize IgE antibodies to various allergens taken into the body via natural routes: pollen, dust and animal hairs via the respiratory tract, and food via the gastrointestinal tract. Clinically, there is asthma, allergic rhinitis, conjunctivitis, hay fever, and childhood eczema.

There are no data that would suggest that atopy could be a risk factor for making antibodies against anaesthetic agents. In the past, however, atopy has been considered to be a risk factor for sensitization to muscle relaxants; this was because high numbers of atopic patients were found in the first series of patients who had an anaphylactic shock during anaesthesia. When the atopy was investigated thoroughly with specific immunological tests, the differences between atopic patients who have had an allergic shock to suxamethonium and controls disappear [13]. On the other hand, it was shown that the basophils of atopic patients released histamine more easily [14,15]. Atopy would therefore be a risk factor for histamine release when anaesthetic agents or other histamine-releasing drugs, such as atracurium, mivacurium, propofol

or gelatin, are injected rapidly.

Fuchs *et al.* [12•] have recently shown that atopic patients with asthma or an allergic rhinitis to grass or weed pollens could have a cross-sensitivity to latex. Atopy may therefore be a risk factor for peranaesthetic allergic reactions to latex. There is always a high number of atopic patients in the series of those sensitized to latex [16,17,18•,19•].

Drug allergy

Allergy to anaesthetic agents is the first risk factor to consider. An unexplained life-threatening reaction during a previous anaesthetic might be an allergic reaction. It is a major risk factor for a renewed reaction if the drug to which the patient is allergic is given again. This again requires that the patient's anaesthetic history be as detailed as possible, and that, when there has been such a previous reaction, allergological investigations be carried out to search for an allergy to local or general anaesthetic agents.

Allergy to local anaesthetics is quite exceptional. In France, in a series of 1000 patients who had anaphylactic shock during anaesthesia of established immunological origin between 1992 and 1994, local anaesthetic agents were involved in only 0.7% of cases [2]. Fisher and Bowey [20•] also investigated, over a 20 year period, 208 patients who were thought to have had an allergic reaction to a local anaesthetic. The IgE mechanism of this reaction was proved in only four patients. In the other patients, causes included vasovagal attacks, possible reactions to a drug additive, psychological reactions, intravascular adrenaline, and reactions to other drugs. Fisher and Bowey [20•] checked the safety of local anaesthetics by progressive challenge. Two case reports [21,22] have recently been published.

A known allergy to a muscle relaxant is a confirmed risk factor for a renewed shock if a muscle relaxant is again given to the patient, even if the agent used is different from the one which gave the first shock, and even if it is a new muscle relaxant which the patient has never had. The high incidence of cross-anaphylaxis means that another muscle relaxant should not be injected into a patient if it has not been tested beforehand. The muscle relaxant which gives negative skin tests is the one that must be used [4•,23,24].

With regard to allergy to other drugs (antibiotics, pain killers, heparin, protamine, aprotinin), there are no data to indicate that particular care should be exercised in the choice of anaesthetic agents in these patients. The drug to which the patient is allergic will of course have to be avoided.

Latex allergy

All surgery is potentially lethal in patients who are known to be allergic to latex, as well as in those who belong to one or other of the groups at risk for latex allergy.

The first signs which suggest an allergy are pruritus, urticaria, or contact angioedema. In patients who are more sensitive than this, conjunctivitis, rhinitis, and asthma occur when wearing gloves containing natural latex, or when the patient is in an area where the air is polluted by latex particles. Anaphylactic shock is one of the most serious complications reported during surgery or after giving oxytocin to the mother after childbirth [2]. Patients who are at risk of having latent sensitivity to latex must be routinely looked for. They have high levels of latex-specific IgE antibodies, which can set off an anaphylactic shock during surgery if this is not carried out in a latex-free environment.

The groups of people at risk are:

* Health workers who wear gloves or work in areas where the air concentration of latex particles is high (operating rooms). The prevalence of sensitivity is approximately 10%; this reaches 15.8% in anaesthetic staff [18•]. Dental school students are also at high risk of latex sensitization; whereas there is 0% sensitivity in year 1 and year 2 students, there is 6% in year 3 and 10% in year 4 students [25•]. The risk of sensitization increases with an increase in exposure.

For local anaesthetics, progressive challenge testing may be used. This technique was described by Fisher and Bowey [20•]: a solution of a 1 in 100 dilution of additive-free 1% local anaesthetic was first injected intradermally to raise a 1 mm bleb. A positive response was a wheal of more than 8 mm 10 min later. If this first injection gave a negative result, then a 1 mm bleb of undiluted local anaesthetic was used 10 min later. If this was uneventful, 2 ml of additive-free lidocaine or bupivacaine were given subcutaneously 10 min later. If this was still uneventful, the patient was certainly not allergic to local anaesthetics and the drug tested could be administered to the patient.

How to carry out the anaesthetic

The anaesthetic technique chosen will depend on the kind of surgery and on the results of the allergological assessment. Of course, this assessment can only be carried out for routine surgery.

No study has shown that any premedication of any kind (antihistamines, steroids) [35] helps to avoid anaphylactic shock in an allergic patient; the only possible strategy will be to avoid the drug which gave positive results during the allergological assessment. It has indeed been shown conclusively that patients allergic to one muscle relaxant can safely be given another agent [4•,23], chosen in accordance with the skin test results. Similarly, for patients allergic to latex, it has been shown that they could be quite safely operated on in a latex-free environment, without any premedication [36,37]. It is therefore most important that all care be taken in the operating and recovery rooms, by replacing all the natural latex with synthetic latex (gloves, catheters, anaesthetic equipment). The operation must be carried out at the start of the operating day, before the operating room air becomes polluted with airborne latex particles [38].

For emergency surgery in an allergic patient, there is no time to carry out an allergological assessment. The anaesthetic technique will again depend on the allergic history of the patient:

- * For patients who have had unexplained reactions during a previous general anaesthetic, regional blocks or general anaesthesia without any muscle relaxant must be used, for fear that the patient may be allergic to muscle relaxants or to latex. The surgery should be carried out in a latex-free environment.
- * For patients who may be allergic to a local anaesthetic general anaesthesia should be preferred. Should a regional block be necessary, however, it ought only to be carried out once a challenge test has proved negative [20•].
- * For patients who are known to be allergic to a muscle relaxant, all muscle relaxants must be avoided.
- * For patients with a high risk of being sensitive to latex, the surgery should be carried out in a latex-free environment. To help ensure this, a set of latex-free equipment should always be available in all operating rooms: several sizes of synthetic latex gloves, catheters, tubing, syringes, as well as an anaesthetic respirator with connections, tubing and internal circuit that contain no natural latex.

Conclusion

Among all patients who say they are allergic, a thorough preanaesthetic history is the most important way of detecting those who are truly at risk of having an abnormal reaction during anaesthesia, such as an allergic shock, cardiovascular collapse, or bronchospasm. One must pay particular attention to the following patients: those who have already had such a reaction during a previous anaesthetic; those who say they are allergic to local anaesthetics, or muscle relaxants; those who are at risk of being sensitive to latex. Because there is no premedication which can prevent an allergic reaction, the choice of safe anaesthetic agents will depend on the allergological assessment. For emergency surgery, it is best to be extremist, and therefore to avoid using muscle relaxants or local anaesthetics, and to carry out the surgery in a latex-free environment.

Acknowledgement

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Appendix 1. Preanaesthetic questionnaire for the allergic patient

YES NO 1 Have you had any local anaesthetics? [white square] [white square] Were there any incidents during this? [white square] [white square] What were they? 2 Have you had any general anaesthetics? [white square] [white square] Were there any incidents during this? [white square] [white square] What were they? 3 Have you had a regional block, : such as a spinal or epidural anaesthesia: or anaesthesia of a limb only? [white square] [white square] Were there any incidents during this? [white square] [white square] What were they? 4: Are you allergic to: YES NO Drugs: antibiotics [white square] [white square] which ones? aspirin [white square] [white square] anti-inflammatory drugs [white square] [white square] others [white square] [white square] which one? Foods: which ones? [white square] [white square] YES NO Latex in: rubber gloves [white square] [white square] balloons [white square] [white square] condoms [white square] [white square] others [white square] [white square] Are you allergic to anything else? [white square] [white square] What? 4: Do you have, or have you had during childhood: YES NO asthma [white square] [white square] hayfever [white square] [white square] childhood eczema [white square] [white square] [\[Context Link\]](#)

Table 1

Substances	<i>n</i>	%
Muscle relaxants	610	59.2
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Table 1. Substances responsible for 1000 cases of clinical anaphylaxis during anaesthesia in France over 2 years (1992-1994) [\[2\]](#)
From: Bouaziz: Curr Opin Anaesthesiol, Volume 11(3).June 1998.339-344

Table 2

Anaesthetics (Commercial solutions)	Prick tests		Intradermal tests	
	Dilution	Test doses concentration (mg/ml)	Dilution	Test doses concentration (μ g/ml)
Suxamethonium	Undiluted	10	1/100	100
Atracurium	1/10	1	1/1000	10
Mivacurium	1/10	0.2	1/1000	2
Vecuronium	Undiluted	4	1/10	400
Pancuronium	Undiluted	4	1/10	400
Rocuronium	Undiluted	10	1/10	1000
Propofol	Undiluted	10	1/10	1000
Fentanyl	Undiluted	0.05	1/10	5
Sufentanil	Undiluted	0.05	1/10	5
Alfentanil	Undiluted	0.05	1/10	5
Morphine	1/10	1	1/1000	10

A positive test with these or lesser concentrations is proof of IgE -dependent anaphylaxis. A prick test is positive if the diameter of the oedema is 3 mm, or 2 mm if this occurs twice. An intradermal test is positive if the diameter of the oedema is 8 mm for an injection papule 4 mm in diameter.

Table 2. Concentrations of anaesthetic drugs which do not give any reaction during skin tests in controls
From: Bouaziz: Curr Opin Anaesthesiol, Volume 11(3).June 1998.339-344