



Anesthesiologist's aptitude for pre-operative detection and treatment of latex allergy

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RESUMEN

Antecedentes: la alergia al látex es la segunda causa de anafilaxia perioperatoria. La identificación oportuna de factores de riesgo y manifestaciones clínicas en los pacientes, así como el establecimiento del tratamiento dependen del anestesiólogo.

Objetivo: evaluar la aptitud de los anestesiólogos para identificar y tratar la alergia al látex.

Participantes y métodos: se evaluaron 66 médicos anestesiólogos de cinco hospitales generales del IMSS de la ciudad de Guadalajara, Jalisco, México. La aptitud se determinó mediante un instrumento, estructurado y validado. Se definieron los niveles de aptitud a través de una escala ordinal. El análisis estadístico se realizó con la mediana y U de Mann Whitney.

Resultados: los resultados globales de aptitud del anestesiólogo (de un puntaje máximo de 40) muestran una mediana de 8 y rango de -2 a 27; las frecuencias (número de médicos) por categoría fueron: *Azar* 48 (72.7%); *Muy mala* 11 (16.7%); *Mala* 4 (6.1%); y tan sólo 3 (4.5%) tuvieron una aptitud *Regular*. Ningún médico tuvo *Buena* o *Muy buena* aptitud. Al relacionar este indicador con el resto de las variables de estudio no se demostró significancia estadística (KW 6.478; $p = 0.16617$).

Conclusiones: se identificó una aptitud subóptima en los médicos anestesiólogos evaluados para identificar la alergia al látex, por lo que se propone establecer estrategias de intervención educativa.

Palabras clave: látex, alergia, anafilaxia, cirugía, aptitud.

ABSTRACT

Background: Latex allergy is the second cause of perioperative anaphylaxis. Anesthesiologists play a key role in opportune identification of risk factors, as well as clinical diagnosis and therapeutic management.

Objective: To evaluate the anesthesiologists aptitude to identify and treat latex allergy.

Participants and methods: Sixty-six anesthesiologists from five general hospitals located at Guadalajara, Jalisco, Mexico, were evaluated. Aptitude was determined by applying a validated structured instrument. Aptitude levels were measured by using an ordinal scale. Comparisons were performed using Mann Whitney U test.

Results: Anesthesiologist's global aptitude ranged from -2 to 27 with a median of 8 (from a maximum value in the scale of 40); frequencies by each category of the scale were: *Random* 48 (72.7%), *Very bad* 11 (16.7%), *Bad* 4 (6.1%) and *Medium* only 3 (4.5%). Both *Good* and *Very good* categories registered no anesthesiologist. The relationship of this indicator with other variables did not reach statistical significance (KW 6.478; $p = 0.16617$).

Conclusions: A suboptimal aptitude was identified among anesthesiologists regarding identification of latex allergy. A need to establish new strategies for educative intervention in order to improve this issue was identified.

Key words: latex, allergy, anaphylaxis, surgery, aptitude.

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Natural latex is an important cause of allergy in individuals with risk factors. Neuromuscular relaxants together with natural latex are among the most studied agents responsible for pre-operative anaphylaxis. Allergic reaction to latex represents, in most cases, an immune response regulated by IgE antibodies (type I hypersensitivity). This type of reaction is produced in individuals who have previously been in contact with latex and have formed sensitivity, the same as in other common forms of allergies. These types of reactions are also more frequent in certain risk groups, such as: health personnel, patients with congenital defects (spina bifida, urologic, myelomeningocele), those who have undergone multiple surgical interventions and a history of repeated exposure – specially in serous and mucous – to materials such as latex. There is a known existence in patients with atopy history, in rubber and plastic workers, janitors and patients with a history of latex intolerance to products such as: balls, balloons, gloves, preservatives, etc. There are cross reactions between latex and food antigens (bananas, cashews, avocado, celery, granade, etc), these allergens have an antigenic action very similar to latex, clinically and immunologically.^{1,2}

Immunopathogenesis of allergies to latex is not completely understood. Several proteins have been identified from natural latex extracts that adhere to IgE. The main one being Hevein b 6, formed from prohevein (Hev b 6.01) and two Hevein post-transcriptional proteins (Hev b 6.02 and Hev b 6.03). These three components act like independent immunogens. In the original Hev b 6.01 protein are found regions responsible for the IgE binding, as well as as the proliferative response of the T lymphocyte. Hev b 6.02 domain contains discontinuous epitopes that can recognize the B lymphocyte, while Hev b 6.03 is a better inductor of the proliferative response for having sequentiated unions to HLA-DR4.^{3,4} Though this, it is possible to initiate an acquired immune response directed to immunogenous, latex related proteins activated by allergenic-specific T CD4+ lymphocytes. Identification of T cell dominant epitope is important and decisive for the development of a potential specific immunotherapy.⁵

Clinical spectrum includes slight dermatitis cases that may or may not affect mucous, together with urti-

caria, pruritus and exanthema being the most frequent. Other forms in which it manifests are rhinitis respiratory profiles and bronchial obstruction. Only in rare occasions do lethal symptoms appear such as anaphylaxis convulsion, frequently observed during anesthesia.^{3,4} Pre-operative identification of high risk patients and preventive measures may decrease latex allergy and alaphilaxy incidences.⁵⁻⁷

The severity of the immediate reaction depends on the level of sensitivity and the amount of latex in which the person comes in contact with. Greatest danger of suffering extreme reactions occurs when latex comes in contact with humid areas of skin or inner parts during surgery, due to the body absorbing more quickly a larger amount of allergen, not forgetting that latex may be suspended in the air and can cause respiratory symptoms. Latex proteins may adhere to the powder used in latex gloves, in using these gloves these particles together with latex allergens fly through the air, where they can be inhaled or come to contact with the nose or the eyes and can cause symptoms.

High levels of this type of allergenic dust has been measured in operating rooms. For this reason the American Society of Anesthesiologists have recommended who patients that have been identified as allergic to latex be the first to use operating rooms, which is when the concentration of these airborne allergenics (latex) is minimum, the use of non-powdered or synthetic gloves is also recommended (vinyl or nitril), reducing risk of reaction, and the use of a physiologic solution on the gloves to remove the excess of dust.^{2,8-12}

For these reasons we consider important to determine clinical aptitude¹³ (set of capacities that allow a physician to identify and treat a specific problem related to health attention) of the anesthesiologist, as being crucial within the staff that can identify and treat patients which can potentially be allergic to latex.

PATIENTS AND METHODS

A transversal analytical trial was performed with anesthesiologists within five general IMSS hospitals in the Guadalajara metropolitan area, these identified as A, B, C, D and E.

Those coded as A, B and D correspond to general zone hospitals, while those coded as C and E correspond to general regional hospitals.

Inclusion criteria: Anesthesiologists pertaining to the IMSS payroll staff in both morning and night shift. A written approval was signed to participate in the trial.

Exclusion criteria: Anesthesiologists identified as being physically absent from the payroll staff (commissioned, scholarship, permit or vacations) the moment the clinical trial was performed. Studying an internship in anesthesiology.

Elimination criteria: Omitted response in more than 50% the questions.

Aptitude definition: The set of capacities involved in the determined clinical situation (real problem patients), together with the current education level in which the doctor is found.

Aptitude detection and its level

In order to evaluate, a group of experts used a modified Delphi considering an ordinary penta-categoric measuring scale (Very Good, Good, Regular, Bad, Very Bad)

Four measurable domains were considered:

- a) **Aptitude in making a compatible diagnosis.** This refers to the fact that elements in the clinical case correspond to the illness as a result of the diagnostics.
- b) **Aptitude in interpreting and recognizing risk factors.** This refers to the proven existence of background or current condition of the patient that not having a current illness still may result in the appearance or worsening of such.
- c) **Aptitude judging diagnostic indicators.** These are data favoring the existence of clinical data whether it be laboratory or cabinet, these not only form part but are important base in making a diagnosis of this illness.
- d) **Aptitude in selecting the appropriate therapeutic resources.** This makes reference to certain therapeutic or recommendation measures. Preventive and follow up are the most efficient in these cases with clear potential benefits and few undesirable side effects. This also refers to the use or omission of certain therapeutic resources whether they be necessary or not or whether they be harmful being chosen.

Aptitude measuring tool and its development

A group of experts on the subject were gathered together, these people gathered one or more qualification (anesthesiologists, medical school professor with investigation background). Five cases of patients with pre-operative latex allergies were selected. 80 questions were elaborated on each of the indicators that were going to be explored, these questionnaires were balanced between correct (50%) and incorrect (50%) answers and balanced between the number of questions for each indicator (10 for diagnostics, 24 for risk, 24 for diagnostics indicators, 22 to select the appropriate therapeutic resources). Each correct response is worth one point, incorrect response subtracts one point and response "I don't know" is worth 0 points.

In order to validate the content, the test was first submitted to the group of experts for a first round of observations, suggestions and modifications with due pertinence. In a second round of experts the final version of this was generated selecting those phrases which were voted on by the majority of the comity. Test of this questionnaire where applied to a group of anesthesiologists who work in a different government institution that mentioned. A Richard-K value of 0.86 was obtained showing internal consistency.

The final application of this test was made directly in the selected hospitals and applied to the universe of anesthesiologists. The grading of the test was done using a blind procedure.

Work hypothesis

Anesthesiologists have the clinical aptitude to handle patients with natural latex allergies during or before any operation or procedure.

Statistical analysis

Median with minimal and maximal values were used in the descriptive phase. Then the Mann-Whitney U was used for the inferential phase. The Kuder Richardson¹⁴ formula was applied to validate the questionnaire, the Perez-Padilla-Viniegra formula was used to calculate those results which had a random explanation. From these results the levels were calculated and set at Very Good (36 to 40); Good (30 to 35); Regular (24 to 29); Bad (18 to 23); Very Bad (12 to 17) Random Explanation (0 to 11).

Ethics

In accordance to the General Health Law in matter of research on human beings, in article 17, this was a trial without risks, respecting confidentiality and the right of not participating from the anesthesiologists.

RESULTS

A coefficient of 0.90 was obtained using the Kuder-Richardson test. A score of 11 or under for the Perez-Padilla-Viniegra test for estimating random results. Table 1 shows the distribution of anesthesiologists in different hospitals within the Guadalajara metropolitan area that participated in this trial, the total being 66 (47.8%). Reasons for exclusion were commissions, scholarships, permits, vacations and physical absence during the time of the trial. The distribution of anesthesiologists was 38 (57.5%) for morning shift and 28 (42.4%) for evening shift.

Table 1. Anesthesiologists from different general hospitals participating in the study

General hospital	Staff	Sample	Percentage
A	29	11	38
B	28	19	68
C	36	10	28
D	30	09	30
E	29	17	59
Total	139	66	47.4

The results of the evaluation that determines whether anesthesiologists have the aptitude to establish clinical manifestations caused by materials that contain latex, used in patient care before or during operation, are shown in Table 2. In order to evaluate this, a 40 reactive questionnaire was used, in each question answers where either "false", "true" or "I don't know". Of the participants 48 (72.7%) doctors where within the group of questions that could be answered randomly (questions 1 through 11). Eleven (16.7%) doctors had "Very bad" Aptitude; 4 (6.1%) "Bad"; only 3 (4.5%) anesthesiologists "Regular" Aptitude. Not one doctor was found to be within the scales 30 to 35 or 36 to 40, which correspond to the "Good" and "Very good" aptitudes, respectively.

Table 2. Anesthesiologists' aptitude according to results scale

Category	Aptitude	Physicians (%)
0-11	Random	48 (72.7)
12-17	Very bad	11 (16.7)
18-23	Bad	4 (6.1)
24-29	Regular	3 (4.5)
30-35	Good	0
36-40	Very good	0

A comparative between general hospitals and aptitude as well as an intra-group analysis is shown in Table 3. Hospital A had 11 doctors participating with a median of 4 (range -2 to 10); Hospital B a participation of 19 doctors with a median of 10 (range 0 to 27); Hospital C 10 doctors with a median of 9 (range -3 to 20); Hospital D 9 doctors with a median of 8 (range 2 to 16); Finally hospital E 17 doctors with a median of 7 (range 0 to 26), not finding any statistically significant difference ($p = 0.16$).

Table 3. Results of the anesthesiologists' overall aptitude assessment

General hospital	Number of physicians	Average (Range)
A	11	4 (-2 to 10)
D	9	10 (0 to 27)
E	17	9 (2 to 16)
B	19	8 (-3 to 20)
C	10	7 (0 to 26)

Total of questions = 40.

Kruskal-Wallis = 6.478 ($p = 0.166$)

The results of the clinical aptitude indicator test to establish the diagnostic in a real case are shown in Table 4. A comparative was made from the anesthesiologists from each of the different hospitals between the medians and aptitude indicators: clinical diagnostics, risk factors, pre-operative anaphylaxis diagnostics and treatment or prevention, not finding any statistically significant difference ($p = 0.006$, $p = 0.007$, $p = 0.1$ and $p = 0.1$, respectively). The highest median observed to establish the clinical diagnostics corresponded to general hospital B. Aptitude to establish risk factors was established in the specialties where the lowest grades were observed in all hospitals, for even one of them obtaining a grade of -1. Recognizing a pre-operative anaphylaxis was

Table 4. Comparative table of aptitude indicators in each general hospital

Aptitude indicator (Number of questions)	General Hospital Average (Range)					<i>p</i>
	A	B	C	D	E	
Clinical diagnosis (5)	1 (-2 to 5)	4 (0 to 5)	1 (-2 to 5)	3 (0 to 5)	1 (1 to 5)	0.06
Risk factors (12)	-1 (-4 to 2)	0 (-2 to 6)	1 (-2 to 6)	1 (-2 to 5)	1 (-9 to 6)	0.07
Diagnosing perioperative anaphylaxis (12)	2 (-2 to 6)	7 (2 to 12)	4.5 (1 to 11)	4 (0 to 7)	2 (-2 to 10)	0.1
Treatment or prevention (11)	1 (0 to 5)	3 (-3 to 7)	2.5 (-2 to 5)	0 (-2 to 8)	2 (-2 to 7)	0.10

Total of questions = 40.

General overall aptitude. Kruskal-Wallis (equivalent to χ^2) = 5.509 (p = 0.23).

also one of the lowest medians observed, the highest one being 7 in general hospital B. The results of the aptitude evaluation to give treatment or preventative measures also found low grades, even evaluations with 0 score on them.

DISCUSSION

This study evaluated aptitude of the anesthesiologist against manifestations produced by rubber an natural latex, before or during surgery, against a real clinical case, validated and chosen by a group of experts among five trans-operative cases of anaphylaxis.^{8,16-20} The clinical case belongs to a teenage woman with myelodysplasia history that had been submitted to multiple surgeries.

The risk of suffering from inter-operative anaphylaxis due to natural latex is observed²¹⁻²³ in patients when previously have been sensitized, with a prevalence of 0.3% to 6% and patients with atopy which have a probability of 24 times greater to suffer from latex allergies;²⁴ in children with spina bifida (the incidence is even half);^{24,25} in health workers (3% to 17%);^{26,27} in patients with skin inflammatory diseases^{8,23-27} and patients with fruit allergy syndrome.^{6,28,29}

Our results show that 48 anesthesiologists (72.7%) answered randomly, which would extrapolate in the probability that a non health professional would respond with the premise that this person does not have specific knowledge related to latex allergy. This result is the same as published by other researchers in this field,^{30,31} which also refer to this type of health personnel as not having enough technical information on the subject. This corresponds to other results obtained from studies done on quality of life in patients allergic to latex.³² In

Mexico similar results have been obtained from reports evaluating aptitude in gynecological problems.³³

This study shows that in a global scale, anesthesiologists' aptitude is deficient, due to the fact that not one obtained a grade of "Good" or "Very Good". The amount of information on latex allergies in this medium is unknown but it is assumed to be very low amongst general public and health personnel; from this last group, dermatologists and allergists should not be included. It is also important to know if latex allergies is a subject included in university whether pregraduate or postgraduate, and if these are considered in actualization or continuous medical education.

Nevertheless, due to the lack of information on this type of allergy, still in this country there are many reported cases by the use of gloves and other utensils made out of latex used in health institutions.

One interesting point would be to establish if in re-used materials, after thorough sterilization still contain proteins that cause these types of allergies. An issue to develop is also whether any of the cleaning interventions from reusable material modifies incidence or prevalence of latex allergies in people with identified risk factors.^{34,35}

It was to note that the indicator on risk factors had the lowest grade, the questions include main factors related to atopy history with a RR of 24; multiple surgeries (spina bifida patients); latex-fruit allergy syndrome (latex proteins cross with avocado proteins, banana, kiwi and cashews, mainly).

The latex-fruit allergy syndrome is an example of cross reactivity between species taxonomically distinct, that in spite of this, have an evident clinical transcendence. Recent data suggest that class I kitanases, with

a terminal hevein N domain, are a new type of panallergens responsible for this syndrome. The proportion of patients allergic to latex that show allergies related to meals varies from 21% to 58% among considered studies.^{28,36}

The results from this evaluation on aptitudes for treatment or prevention indicate a deficient aptitude in electing treatment options, several doctors even had negative values. In this area of specialization, the change for products and instruments latex free for those used more commonly in hospitals such as: sphygmomanometer, catheters, surgical drainages, gloves, elastic bands, ambus, needles, masks, urinary collectors, tracheal intubation tubes, among others.²⁶

However median was obtained for the aptitude indicator for nosologic pre-operative anaphylaxis diagnosis,^{37,38} general hospital B (zone) obtained a median of 7 (range 2 -12). Its highly probable that common activity influences that allows to recognize different clinical profiles tied with allergic reactions and anaphylaxis, as well as request diagnostic proof that could clear possible causes.

The results of the global evaluation not only show a great variability with respect to the knowledge of latex allergy, but the aptitude deficiency of the doctors that participated in the trial.

Therefore, the need to complement this work with an educative intervention that allows to update the knowledge on allergy to latex and provoke changes in physician's aptitude.^{39,40} What would be highly recommendable is that the aptitude evaluation questionnaire (virtual) be compared with habitual activity before the patient, including abilities for the diagnosis and treatment (technical procedures) of each different clinical profile related to this hypersensitivity state.

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