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# Severe Intraoperative Anaphylaxis to Surgical Gloves: Latex Allergy, an Unfamiliar Condition

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Anaphylactoid reactions during anesthesia are relatively common. Most of these are mild and self-limiting; however, some will be serious with bronchospasm, hypotension, or cardiac arrest.[1] Neuromuscular blocking agents and iv induction agents are most often implicated.[2] However, causative agents are not identified in approximately 16% of the cases.[2] We report two patients with life-threatening IgE-mediated anaphylactic reactions to latex (natural rubber). In one patient failure to identify the responsible source led to anaphylactic reactions during two subsequent operations. Cutaneous allergy (type IV) to rubber gloves causing dermatitis, which is commonly a reaction to rubber additives,[3] is well known to surgeons. However, latex allergy (type I) causing severe intraoperative anaphylactic reactions (urticaria, bronchospasm, shock) has rarely been suspected by anesthesiologists. Latex allergy may cause severe unexplained systemic reactions and should be specifically searched for.

## Report of Two Cases

*Case 1.* This boy was born in 1978 with exstrophy of the bladder. By the age of 6 he had undergone a total of 11 surgical interventions requiring anesthesia; all were uncomplicated. The anesthetic agents used included cyclopropane, halothane, $N_2O$, alcuronium, meperidine, droperidol, flunitrazepam, and ketamine. A history of cutaneous reactions to adhesive tape and amoxycillin was known.

In 1986 an augmentation cystoplasty was planned. After preanesthetic medication with flunitrazepam, he received an inhalational anesthetic (cyclopropane, halothane, $N_2O$, $O_2$) with pancuronium as muscle relaxant. The initial 40 min of the anesthetic were uneventful. About 10 min after laparatomy, a sudden unexplained reaction occurred, with tachycardia of 130, a decrease in blood pressure from 90/60 to 60/30 and an increase in inspiratory airway pressure from 20 to 40 mmHg. Chest auscultation revealed severe bronchospasm. Blood gas analysis drawn from a central venous catheter was *p*H 7.16, $P_{CO_2}$ 87.8 mmHg. A pneumothorax was excluded radiologically. Correct position and patency of the endotracheal tube and the absence of aspiration was documented immediately with fiberoptic bronchoscopy, which showed edematous mucosa and viscous secretions. The operation was suspended and the patient was transferred with his trachea intubated to the intensive care unit. Systolic hypotension of 70–80 mmHg and tachycardia of 140/min resolved with volume administration (900 ml of Ringer's solution over 2 h). The respiratory difficulties improved spontaneously over the next 12 h. His trachea was then extubated without difficulty.

Three months later minor corrective surgery of the penis was performed. The anesthetics included thiopental, halothane, and $N_2O$. This procedure was uneventful.

In 1987 a second attempt at augmentation cystoplasty was undertaken. Anesthesia was induced and maintained with the same drugs used during the initial cystoplasty procedure. Initially the course was uneventful. About 25 min after laparatomy, an unexplained reaction again developed. Blood pressure decreased from 90/50 to 40/28 mmHg, heart rate increased from 110 to 150 beats/min, and inspiratory pressure increased from 16 to 38 mmHg. Oxyhemoglobin saturation decreased to 47% and $P_{CO_2}$ increased to 56.3 mmHg. He was immediately given iv prednisolone 50 mg, clemastine 0.6 mg ($H_1$ receptor blocker), and 700 ml of Ringer's solution. Symptoms resolved within 15 min and the operation was completed. The trachea was extubated postoperatively with no additional difficulties.

Allergy testing with skin tests for antibiotics (penicilline, amoxycilline, cotrimoxazole, and ornidazole) and neuromuscular blocking agents (succinylcholine, pancuronium, alcuronium, and vecuronium) proved negative. Radioallergosorbent tests (RAST) for penicillin, cotrimoxazole, succinylcholine, and pancuronium were also negative. Total IgE was slightly elevated. Pulmonary function testing (methacholine challenge) showed no bronchial hyperreactivity.

In 1988 the patient presented with an incarcerated inguinal hernia. Preoperatively, the patient was given prednisolone 25 mg and clemastine 4 mg im, in view of his previous history. A spinal anesthetic (hyperbaric tetracaine 10 mg with epinephrine) was selected on this occasion. The sensory block rose to $Th_6$. The operation progressed uneventfully for about 30 min. While the surgeon was handling the peritoneal sac, chest auscultation revealed wheezing; end-tidal $CO_2$ (nasal cannula) decreased from 44.3 to 32.3 mmHg, and transcutaneous oxyhemoglobin saturation decreased from 97% to 91%. Circulatory parameters remained stable. Bronchospasm subsided within 10 min after 0.5 mg atropine iv and oxygen administration. The postoperative course was uneventful.

An attending allergologist later learned that the boy had reacted with rhinoconjunctivitis when blowing up balloons and had developed urticaria when using rubber gloves for painting. Allergy testing for latex was initiated and demonstrated IgE-mediated allergy. Results are shown in table 1.

*Case 2.* This 8-yr-old boy was scheduled for esophagoscopy, orchidopexy, circumcision, and tonsillectomy in 1987. He had undergone a total of 29 surgical procedures requiring anesthesia since birth for repair of omphalocele and esophageal atresia. All operations had been without incidence. The anesthetic drugs and gases used included cyclopropane, halothane, $N_2O$, succinylcholine, alcuronium, ketamine, atropine, thiopental, diazepam, flunitrazepam, meperidine, and droperidol. He had experienced asthma-like attacks, precipitated by a variety of foods. Adhesive tape provoked skin rash. However, allergy

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TABLE 1. Testing for Latex Allergy

| | Friction test[11] with surgical glove | Conjunctival contact with surgical glove | RAST* for Latex |
|---|---|---|---|
| Case 1 | Wheal and flare | Conjunctivitis | Positive 0.45 PRU/ml (class 1) |
| Case 2 | Wheal and flare | Not done | Positive 13.8 PRU/ml (class 3) |

PRU-Phadezym RAST units.
* Latex (K 82), Phadebas-RAST; Pharmacia Diagnostics AB, Uppsala, Sweden.

workup (total IgE, RAST for various foodstuffs, pollens, and moulds; skin tests for pollens, animal epithelia, moulds, and mites) had been negative. He had also suffered recurrent episodes of severe pseudocroup, once requiring tracheotomy. During that operation he developed severe unexplained bronchospasm.

After preanesthetic medication with flunitrazepam, an inhalational induction with cyclopropane, halothane, and $N_2O$ was carried out. Endotracheal intubation was facilitated with pancuronium. Ventilatory and circulatory parameters were normal during the ensuing 40 min, during which esophagoscopy and orchidopexy were completed. During circumcision blood pressure suddenly decreased from 95/60 to 50/30 mmHg and simultaneously heart rate increased to 140 beats/min. Inspiratory pressures increased markedly, severe bronchospasm being apparent on auscultation. Oxyhemoglobin saturation decreased from 94% to 80%. Over the next few minutes angioedema of the head and neck developed. Treatment included 100% $O_2$, prednisolone (25 mg), metaproterenol (1 mg), volume-loading (400 ml Ringer's solution), and 0.02 mg of epinephrine iv. Over the next 20 min, blood pressure returned to normal and bronchospasm subsided. Tonsillectomy was postponed and the trachea extubated. Postoperatively, stridor and mild retractions persisted for several hours.

After hospital discharge this boy was also investigated for latex allergy. He had also developed rhinoconjunctivitis after playing with rubber balloons, and his testing revealed severe latex allergy. The results are shown in table 1. No other causative allergens could be identified in either patient.

## DISCUSSION

Contact allergies (type IV) to rubber gloves are well known. They are usually caused by rubber additives.[3] Reports of true IgE-mediated latex allergy have appeared only since 1979.[4] The responsible IgE-antibodies react with latex protein[5] and cause anaphylactic symptoms, such as urticaria, bronchospasm, and circulatory collapse. Watkins[1] suspected allergy to red rubber endotracheal tubes as a possible cause of severe intraoperative bronchospasm without presenting serologic evidence. Cases of IgE-mediated anaphylactic reactions to latex gloves, occurring during gynecologic and surgical procedures, have been described.[6–9] No comparable reports have appeared in the anesthetic literature.

Latex is a common component of equipment used in anesthesia and surgery (table 2). The most severe reactions reported in the literature occurred after contact of rubber gloves with vaginal or peritoneal mucous membranes,[7,8] or contact of rubber dam with buccosal membranes.[7] The responsible allergenic protein must be eluted from the rubber[5] and absorbed into the circulation to cause systemic symptoms. During operations surgical gloves are in repeated and intense contact with mucous membranes. Tissue barriers are destroyed and blood and secretions provide a moist environment favoring elution and absorption of the allergen in relevant amounts. This could explain why several patients[6–8] developed localized cutaneous reactions when wearing rubber gloves but reacted with severe anaphylaxis during surgical, gynecologic, or dental procedures. This might also explain why patient 1, despite being sensitized, did not react during a superficial penile operation with minimal bleeding, three months after his first anaphylactic episode. Normal contact of intact skin with rubber anesthetic or operating room equipment might not be sufficient to precipitate anaphylaxis. The fact that so few cases of IgE-mediated latex allergy have been reported to date, despite the ubiquity of rubber in daily life, suggests the necessity of long-standing and intense contact. This is most likely to take place in females wearing household rubber gloves,[7] in medical personnel,[5,6,8] and in patients having undergone multiple operations, such as our and Slater's[9] patients. In children playing with rubber balloons may lead to sensitization.[9,10]

Latex allergy should be suspected and investigated if unexpected anaphylactic reactions occur after the start of the surgical procedure without obvious relation to any drug administration. Suspicion should rise if a history of contact allergy to rubber gloves or adverse reaction to blowing up balloons is obtained. Specific testing can be done with RAST for latex-specific IgE or skin tests (Prick-, Scratch-, or Epicutantests[7,9,11]). However, skin tests are not completely harmless.

In sensitized individuals exposure can be prevented by using vinyl or neopren surgical gloves and medical equipment made of synthetic rubber or plastic. Latex-sensitive patients should wear allergy alert bracelets in the event emergency surgery is needed.

TABLE 2. Latex-containing Medical Equipment

| | |
|---|---|
| Endotracheal tubes | Surgical gloves |
| Face masks | Adhesive tape |
| Pharyngeal airways | Elastic bandages |
| Bite blocks | Rubber pads |
| Teeth protectors | Protective sheets |
| Ventilator hoses | Urinary catheters |
| Ventilator bellows | Drains |
| Blood pressure cuffs | Electrode pads |
| | Intestinal tubes |
| | Stomach tubes |
| | Condom urinals |
| | Rubber dams (dentistry) |

(Modified from Ehl W, Hartjen A, Thiel C, Aulepp H, Fuchs E: Latex-allergien als IgE-vermittelte sofortreaktionen. Allergologie 11: 182–187, 1988, with permission.)

Two children who developed life-threatening intraoperative anaphylactic reactions are reported. Latex (natural rubber) was identified as causative agent by demonstration of specific anti-Latex IgE with RAST and positive skin tests. Surgical gloves and numerous components of anesthetic and surgical equipment contain latex and can precipitate anaphylactic reactions in sensitized patients. Laboratory investigations to identify such patients, a list of latex-containing equipment, and necessary measures to prevent rubber contact during surgery in sensitized patients are presented.

## Addendum

Since this paper was submitted, patient 1 has undergone another extensive surgical procedure (orthoplasty of the penis, island flap, closure of multiple fistulas) requiring general anesthesia. All latex-containing equipment was replaced with commercially available plastic or silastic material, except for the ventilator bellow, for which an alternative was not available. The surgeons used neoprene gloves. The patient did not receive any prophylactic steroid or antihistaminic medication. Induction and maintenance drugs were the same used during his previous cystoplasty procedures. The course of this anesthetic was completely uneventful. RAST determinations for latex before, during, and after operation showed the following values: 1.2 PRU/ml, 1.2 PRU/ml, and 0.71 PRU/ml (all corresponding to RAST class 2), which indicates that the patient was still sensitized to about the same degree as during the previous intraoperative reactions.

## References

1. Watkins J: Adverse anaesthetic reactions. Anaesthesia 40:797–800, 1985
2. Galletly DC, Treuren BC: Anaphylactoid reactions during anaesthesia. Anaesthesia 40:329–333, 1985
3. Lammintausta K, Kalimo K: Sensitivity to rubber. Derm Beruf Umwelt 33:204–208, 1985
4. Nutter AF: Contact urticaria to rubber. Br J Dermatol 101:597–598, 1979
5. Carillo T, Cuevas M, Munoz T, Hinojosa M, Moneo I: Contact urticaria and rhinitis from latex surgical gloves. Contact Dermatitis 15:69–72, 1986
6. Leynadier F, Pecquet C, Dry J: Choc anaphylactique peropératoire au latex des gants chirurgicaux. Presse Med 17:390–391, 1988
7. Axelsson JGK, Johansson SGO, Wrangsjö K: IgE-mediated anaphylactoid reactions to rubber. Allergy 42:46–50, 1987
8. Turjanmaa K, Reunala T, Tuimala R, Kärkkäinen T: Allergy to latex gloves: Unusual complication during delivery. Br Med J 297:1029, 1988
9. Slater JE: Rubber anaphylaxis. N Engl J Med 320:1126–1130, 1989
10. Axelsson IGK, Eriksson M, Wrangsjö K: Anaphylaxis and angioedema due to rubber allergy in children. Acta Paediatr Scand 77:314–316, 1988
11. Gronemeyer W, Debelic M: Der sogenannte "Reibtest", seine Anwendung und klinische Bedeutung. Dermatologica 134:208–218, 1967