

Table 1. Identification of Mold Species From Conifer Specimens

Mold ^a	No. of isolates	No. identified phenotypically	No. identified by ITS sequencing
<i>Aspergillus</i> sp	10	4	6
<i>Penicillium</i> sp	9	5	4
<i>Cladosporium</i> sp	8	7	1
<i>Alternaria</i> sp	7	7	0
<i>Microdiplodia</i> sp	4	0	4
<i>Pseudocercospora</i> <i>fraxini</i> (<i>Mycosphaerella</i> sp)	2	0	2
<i>Hormonema</i> <i>dematioides</i> (<i>Sydowia polyspora</i>)	2	0	2
<i>Nigrospora</i> sp	2	0	2
<i>Trichoderma</i> sp (<i>Hypocrea</i> sp)	1	0	1
<i>Stachybotrys</i> sp	1	0	1
<i>Leptosphaerulina</i> sp	1	0	1
Unidentified	5	0	0
Lost	1	NA	NA
Total	53	23	24

Abbreviations: ITS, internal transcribed spacer; NA, not applicable.

^a Names in parentheses are associated teleomorphs that demonstrated a close match in GenBank.

quence analysis (Table 1). Five nonsporulating molds did not amplify with the ITS primers and remained unidentified. One mold isolate was lost. Most isolates (34) were potential allergens: *Aspergillus*, *Penicillium*, *Cladosporium*, and *Alternaria*. Of the 26 samples yielding mold isolates, the number of different isolates varied from 1 to 6. The aforementioned 4 molds were found in individual samples as follows: *Alternaria*, 7; *Aspergillus*, 6; *Cladosporium*, 7; and *Penicillium*, 7. The remaining isolates were environmental colonizers or plant pathogens, with rare or no association with human disease.

The purpose of this study was to survey the variety of molds that could be isolated from live Christmas trees that resided in homes during the Christmas season. The use of DNA sequence analysis allowed identification of molds that could not be identified phenotypically. Most molds that were identified are potential allergens and have been shown to increase the risk of wheeze, persistent cough, and allergic sensitization in infants.⁸ It is possible that molds were present in homes before the entrance of the conifers. Further studies seem warranted.

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1. Johnston NW. The similarities and differences of epidemic cycles of chronic obstructive pulmonary disease and asthma exacerbations. *Proc Am Thorac Soc*. 2007; 4:591–596.
2. Wyse DM, Malloch D. Christmas tree allergy: mould and pollen studies. *Can Med Assoc J*. 1970;103:1272–1276.

3. Watson C, Rockwell W, Santilli J. Mold allergy and live Christmas trees. Paper presented at: American College of Allergy, Asthma & Immunology Annual Meeting; 2007; Dallas, Texas.
4. Iwen PC, Hinrichs SH, Rupp ME. Utilization of the internal transcribed spacer regions as molecular targets to detect and identify fungal pathogens. *Med Mycol*. 2002;40:87–109.
5. Pounder JJ, Simmon KE, Barton CA, Hohmann SL, Brandt ME, Petti CA. Discovering potential pathogens among fungi identified as nonsporulating molds. *J Clin Microbiol*. 2007;45:568–571.
6. Pitkaranta MT, Meklin T, Hyvarinen A, et al. Analysis of fungal flora in indoor dust by ribosomal DNA sequence analysis, quantitative PCR, and culture. *Appl Environ Microbiol*. 2008;74:233–244.
7. Ciardo DE, Schar G, Altwegg M, Bottger EC, Bosshard PP. Identification of moulds in the diagnostic laboratory: an algorithm implementing molecular and phenotypic methods. *Diag Microbiol Infect Dis*. 2007;59:49–60.
8. Rosenbaum PF, Crawford JA, Anagnost SE, et al. Indoor airborne fungi and wheeze in the first year of life among a cohort of infants at risk for asthma. *J Expo Sci Environ Epidemiol*. 2009;20:503–515.

ENTEROVIRUS-SPECIFIC IGG IN INTRAVENOUS IMMUNOGLOBULIN PREPARATIONS

Patients with humoral immunodeficiencies, such as common variable immunodeficiency and X-linked agammaglobulinemia, are at increased risk of developing enterovirus infections.¹ In an immunocompetent host, more than 90% of nonpolio enterovirus infections are asymptomatic or result only in a mild febrile illness. However, enterovirus infections in patients with humoral immunodeficiency often become chronic and more severe and may manifest as meningoencephalitis, hepatitis, dermatomyositis, arthritis, or myocarditis.^{2,3}

Currently, no definitive therapy is available for severe enterovirus infections in immunodeficient patients, but different therapeutic approaches have been attempted. Pleconaril, an experimental antiviral drug initially studied for use against rhinovirus, showed some promise in the treatment of enteroviral infections, but its use was eventually discontinued because of safety concerns. Intravenous immunoglobulin (IVIG) is the main therapeutic modality in humoral immunodeficiencies and may play some role in prophylaxis against the development of enterovirus infections. Enterovirus-specific IgG antibodies in IVIG preparations are likely responsible for the prophylactic effects, and enterovirus antibody titers have been shown to increase after IVIG infusions.⁴ However, enterovirus infections may still occur in patients receiving IVIG. In this scenario, replacement-dose IVIG, high-dose IVIG, and intraventricular and intrathecal immunoglobulin have been attempted, with mixed results and no formal studies.^{1,3,5} One logical recommendation is that the IVIG preparations administered to immunodeficient patients with enterovirus infections should contain high quantities of enterovirus-specific IgG. Unfortunately, the amount of enterovirus-specific IgG in various IVIG products is not known or reported.

The goal of this study was to determine whether enterovirus-specific antibody is present in various commercially available IVIG preparations and, if present, quantify the amount and assess for differences among the IVIG products. To achieve this, 1-mL samples of 4 commercially available brands (2 with 2 distinct lots) of IVIG were obtained and converted to 5% solutions. Each sample was analyzed via enzyme-linked immunosorbent assay (ELISA) (Serion ELISA Classic ESR 133G Kit; Institut Virion/Serion GmbH, Wurzburg, Germany), which specifically detects enteroviral IgG.

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Table 1. Enterovirus-Specific IgG in IVIG Samples

IVIG brand (lot No.)	Mean (SD) enterovirus IgG, ELISA U/mL
Carimmune (1)	193.3 (8.5) ^a
Carimmune (2)	144.7 (6.8)
Gammagard	233.6 (21.1)
Gammunex	245.0 (23.2)
Octagam (1)	189.9 (16.3)
Octagam (2)	221.2 (12.5)

Abbreviations: ELISA, enzyme-linked immunosorbent assay; IVIG, intravenous immunoglobulin.

^a $P = .005$ when compared with Carimmune lot 2.

The kit includes a standard 96-well plate precoated with heat denatured coxsackievirus type B5 and echovirus type 6 virions, which have been shown to cross-react with enterovirus antibodies. Each sample was measured in quadruplicate along with controls. ELISA results were compared between lots using 1-way analysis of variance. Post hoc pairwise comparisons were made using the Tukey test. The protocol was approved by the Department of Clinical Investigation.

Enterovirus IgG was detected in all samples (Table 1). Significant statistical differences were observed between the 2 Carim-

mune lots but not those of Octagam. Each IVIG sample demonstrated statistically significant differences in enterovirus-specific IgG levels when compared with samples from other manufacturers.

Few studies have evaluated enterovirus-specific IgG in IVIG products. Galama et al⁶ assessed enterovirus-specific IgG titers via neutralization assays in 2 IVIG preparations from the Netherlands. They found up to 8-fold differences in titers between the 2 preparations. Dagan et al⁷ evaluated 3 IVIG products via plaque reduction neutralization assays, which revealed no substantial differences among the 3 preparations tested. These results have limited applicability to the IVIG products available in the United States today.

Abzug et al⁸ performed a randomized trial using IVIG (2 lots of Gammagard) in 9 neonates and supportive therapy only in 7 neonates with enteroviral disease and found that IVIG products containing a neutralizing titer of 1:800 or more for the patient's own viral isolate provided a more rapid reduction in viremia and viruria compared with patients who did not receive IVIG or received an IVIG product with enterovirus titers less than 1:800 for the patient's isolate. Faster normalization of clinical findings was demonstrated in the IVIG group. This suggests some benefit in using IVIG preparations with higher titers for the specific enterovirus in infected neonates.

This study has several limitations. A limited number of IVIG samples were evaluated because of supply and cost considerations. Neutralization assay titers and seasonal variation among lots and manufacturers were not assessed. These results cannot be used to directly identify clinically protective levels for any given lot or manufacturer.

The primary objective of this study was achieved in that enterovirus-specific antibodies were present in all brands of IVIG tested. This should provide some reassurance that commercially available IVIG in the United States contains at least some enterovirus-specific antibodies. In the event of enteroviral disease or high-risk exposures, lot-specific measurement of enteroviral-

specific IgG should be considered given the variability identified in this study. We hope that this study will generate interest in disclosing the quantities of enteroviral and other crucial antibodies in each lot of IVIG.

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- McKinney RE Jr, Katz SL, Wilfert CM. Chronic enteroviral meningoencephalitis in agammaglobulinemic patients. *Rev Infect Dis.* 1987;9:334–56.
- Halliday E, Winkelstein J, Webster ADB. Enteroviral infections in primary immunodeficiency (PID): a survey of morbidity and mortality. *J Infect.* 2003;46:1–8.
- Galama JMD. Enteroviral infections in the immunocompromised host. *Rev Med Microbiol.* 1997;8:33–40.
- Galama JMD, Gielen M, Weemaes CMR. Enterovirus antibody titers after IVIG replacement in agammaglobulinemic children. *Clin Microbiol Infect.* 2000;6:629–632.
- Erlendsson K, Swartz T, Dwyer JM. Successful reversal of encephalitis in X-linked hypogammaglobulinemia by intraventricular administration of immunoglobulin. *N Engl J Med.* 1985;312:351–353.
- Galama JMD, Vogels MTE, Jansen GH, Gielen M, Heessen FWA. Antibodies against enteroviruses in intravenous Ig preparations: great variation in titres and poor correlation with the incidence of circulating serotypes. *J Med Virol.* 1997;53:273–276.
- Dagan R, Prather SL, Powell KR, Menegus MA. Neutralizing antibodies to non-polio enteroviruses in human serum globulin. *Pediatr Infect Dis.* 1983;2:454–456.
- Abzug MJ, Keyserling HL, Lee ML, Levin MJ, Rothbart HA. Neonatal enterovirus infection: virology, serology and effects of intravenous immune globulin. *Clin Infect Dis.* 1995;20:1201–1206.

GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE AS A MAJOR ALLERGEN IN RAMBUTAN-INDUCED ANAPHYLAXIS

Rambutan (*Nephelium lappaceum*) is a widely consumed tropical fruit in Thailand and is exported to many countries worldwide. Currently, only 1 case report of rambutan allergy has been reported, but the allergen has never been identified.¹ This work reports 3 new cases and identification and characterization of a rambutan allergen.

Three adult patients, ages 35, 49, and 53 years, had a history of multiple episodes of anaphylactic reactions within 30 minutes after ingestion of half to 2 rambutans. All patients had cutaneous (eg, angioedema, flushing, and urticaria) and respiratory (eg, rhinitis, chest tightness, stridor, and wheezing) symptoms. One patient also had cardiovascular (eg, syncope) and gastrointestinal (eg, nausea and vomiting) symptoms. Patients 1 and 3 had a history of allergic rhinitis and asthma, respectively. No patient had a history of latex allergy. There was no family history of food allergy. A positive prick-to-prick test result to fresh pulp rambutan was demonstrated in all patients, with mean wheal diameters of 16, 3, and 6 mm, but not in 2 healthy controls. Histamine phosphate (10 mg/mL) and glycinated saline were used as positive and negative controls for skin

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