

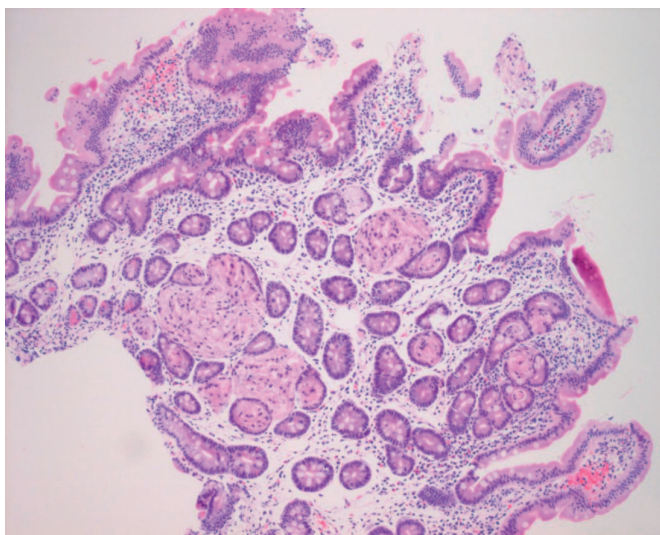


Figure 1. In a duodenal mucosal biopsy specimen, there is patchy villous atrophy and diffuse nonspecific inflammation with eosinophils and lymphoplasmic cells, but no yeast is identified (hematoxylin-eosin, original magnification $\times 100$).

were observed. The stool smear test showed many red and white blood cells. Both blood and stool culture results were negative. Multiple radioallergosorbent test (RIDA Allergy Screen Test; R-Biopharm AG, Darmstadt, Germany) results for yeast and fungi (not *Saccharomyces* or other related species) were all negative, and the serum IgE level was less than 17.6 IU/mL (reference range, 0–230 IU/mL). Neither prick skin testing nor patch testing to Bioflor was performed. The clinical findings were consistent with the diagnostic criteria^{6,7} for an *S. boulardii* lyo-induced gastrointestinal allergy, such as the FPIES adverse reaction. Neither the infant nor his mother had previously taken Bioflor or any other probiotics. A biopsy specimen of the duodenal mucosa, performed 24 hours after the FPIES-like reaction, showed patchy villous atrophy and diffuse nonspecific inflammation with eosinophils (20 cells per high-power field) and lymphoplasmic cells, but no yeast was identified (Fig 1).

FPIES, manifesting as a sepsislike symptom, is the most severe form of non-IgE-mediated gastrointestinal food hypersensitivity in infants. The OFC test remains the diagnostic standard for this disorder. The food specific IgE tests are not helpful.^{6,7} On the basis of the OFC and clinical diagnostic criteria, the present case demonstrated an FPIES-like allergic reaction caused by *S. boulardii*.

Although FPIES is known to be caused by cow's milk and various solid foods, including rice,⁸ there has been no report on cases caused by extracts of yeast. One powder pack of Bioflor is 765 mg and is mainly composed of 471.9 mg of fructose and 282.5 mg of *S. boulardii* in a lyophilized form. Because this patient had no specific symptoms after ingestion of fruits, the fructose contained in the Bioflor was not influential in developing the FPIES-like allergic reaction. Bloody, purulent, and foul-smelling stools indicate that massive inflammation probably occurs in the bowel mucosa in the patient with FPIES undergoing an OFC.⁷

Although *S. boulardii* lyo is a relatively safe probiotic, unexpected allergic reactions can develop. *Saccharomyces boulardii* probiotic should be cautiously administered in patients with latent allergies.

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ANAPHYLACTIC REACTION TO PERMANENT TATTOO INK

Tattoos are increasingly prevalent in Western society. Delayed-hypersensitivity reactions to tattoo ink are well described in the literature, but, to our knowledge, anaphylaxis after permanent tattoos has never been reported.

A 30-year-old woman with suspected tattoo allergy was referred to our clinic for evaluation. Her medical history included seasonal allergic rhinitis, asthma, eczema, and animal allergies to dogs, cats, and horses. The patient received her first multicolored tattoo in 1993, with no adverse reactions. In June 1999, she received a black ink tattoo on her back without adverse reactions. One month later, she had colored ink added to the tattoo. Approximately 12 hours after the procedure, a feeling of heat began at her anus and spread rapidly over her body, followed by the development of hives over her face, chest, and upper back. She experienced acute shortness of breath and intractable abdominal pain. She went to the emergency department, where her symptoms resolved after she was treated with intravenous (IV) diphenhydramine, 2 doses of oral lorazepam, and IV droperidol. Throughout this episode, the tattoo appeared normal. Six months later, the patient returned for further coloring of her tattoo, at which time she experienced similar symptoms, occurring faster and resolving after a regimen of antihistamines and IV methylprednisolone sodium succinate (Solu-Medrol).

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Figure 1. Allergy skin prick testing on a patient's back.

We performed allergy prick skin testing using samples of 13 different ink colors made by 2 different manufacturers (Fig 1). A skin examination was conducted after 10 and 20 minutes, and the patient was monitored for signs of anaphylaxis. Skin reactions noted were a 5-mm wheal with allergen 1 (purple with carbon, made by Superior Prizm Tattoo Inks, Superior Tattoo Equipment, Inc, Phoenix, Arizona) after 10 minutes, then a 3-mm wheal with allergen 8 (blue, also made by Prizm) after 20 minutes. Histamine, the control, caused a 10-mm wheal (No. 14 in Fig 1). Other colors of ink and isotonic sodium chloride solution (not pictured because of arm placement) caused no wheal reaction.

Tattoos are created by injecting ink into the dermis using a hollow needle.¹ Within 12 hours after tattooing, dermal pigmentation, dermal hemorrhage, and epidermal necrosis are evident.² The inks used in tattoos are composed of different pigmented compounds, such as cadmium sulfide (yellow); cobalt (blue); manganese (purple); mercuric sulfide, azo, or cadmium (red); and chromium oxide (green). The inks are suspended in liquid that may include water, ethylene glycol, and other agents. Unfortunately, the manufacturers are not required to print ingredients on their labels, and the Food and Drug Administration does not currently exercise its regulatory authority over tattoos.³ The lack of immediate hypersensitivity to other inks tested from the same manufacturer argues against propellant allergen as the cause of the anaphylaxis; however, we were unable to obtain the ingredient lists from the manufacturers.

Delayed-hypersensitivity reactions have been described in response to tattoo ink, especially reds.⁴ The most common tissue reaction is a localized lichenoid pattern, although distant lesions have been described.⁵ Another well-described pattern of allergic response is granulomatous reactions.⁶ Skin changes occur weeks to years after tattoo placement.

To our knowledge, this is the first case of anaphylaxis to a tattoo ever reported. As is typical of type 1 hypersensitivity reactions, the patient had prior sensitization to colored ink years earlier. The nature of her symptoms, including severe abdominal pain, should be noted.

Nausea, vomiting, diarrhea, and abdominal cramping have been described as part of the anaphylactic reaction, although cardiopulmonary effects are more typical.⁷ Allergy skin testing of our patient demonstrated allergy to purple and blue ink.

Anaphylaxis to dye ingredients has been reported, including allergy to the paraphenylenediamine used to stabilize temporary black henna tattoos.⁵ A single case report of allergy to carmine, a red dye found in campari, has appeared in the literature.⁸ Neither of these ingredients would be expected to be found in tattoo ink.

Lasers have been used since the late 1970s to remove tattoos by breaking down tattoo pigment into smaller particles, allowing for absorption and elimination by macrophages. Currently, a variety of lasers, including Q-switched lasers, are used to remove different colors of tattoo pigment.^{9,10}

To our knowledge, this is the first reported case of anaphylaxis to tattoo ink. Although it is a rare reaction, it is nonetheless important to recognize. Many tattoo ink manufacturers do not list the ingredients used in each ink, making it difficult to identify the precise agent responsible for this reaction. Disclosure of tattoo ink ingredients may allow for better identification of the allergens specifically involved in tattoo anaphylaxis. Although this patient wanted removal of her tattoo, it is unknown if laser tattoo removal would reinitiate anaphylactic reactions for this patient.

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