

Shiitake Mushroom Dermatitis: A Review

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Abstract Shiitake mushroom dermatitis is a cutaneous reaction caused by the consumption of raw or undercooked shiitake mushrooms. Symptoms include linear erythematous eruptions with papules, papulovesicles or plaques, and severe pruritus. It is likely caused by lentinan, a heat-inactivated beta-glucan polysaccharide. Cases were initially reported in Japan but have now been documented in other Asian countries, North America, South America, and Europe, as this mushroom is now cultivated and consumed worldwide. Shiitake mushroom dermatitis may result from mushroom ingestion or from handling, which can result in an allergic contact dermatitis.

Key Points

Clinicians should maintain a high degree of suspicion with this distinct entity for which specific questioning will lead to a diagnosis and intervention that will prevent future episodes.

We discuss the different presentations and diagnosis of shiitake dermatitis.

1 Introduction

Shiitake mushroom dermatitis, originally described in 1977 by Nakamura [1], is an intensely pruritic cutaneous eruption with a linear pattern of papules and papulovesicles due to consumption of raw or undercooked shiitake mushrooms (Fig. 1). In 2012, shiitake mushrooms were the third most produced mushroom worldwide, with an annual production estimated at 4.5 million tons [2]. As Asian cooking has increased in popularity, consumers have greater access to these mushrooms. Accordingly, shiitake mushroom dermatitis is being recognized globally. These edible fungi grow best on oak trees but can also be cultivated from maple trees. Shiitakes are a staple of traditional Asian medicine for their alleged health properties, including anti-hypertensive, cholesterol-reducing, anti-carcinogenic, and immunomodulatory effects [3]. Shiitake mushroom dermatitis has become a noteworthy clinical entity as the mushrooms are now easy to obtain and the risks associated with eating them undercooked or raw are largely unrecognized.

2 Clinical Findings

Shiitake mushroom dermatitis post-ingestion presents as erythematous papules, papulovesicles, or plaques occurring in a flagellate linear pattern that universally affects the trunk (Fig. 2) [4–9]. The extremities and neck are other commonly affected areas, and the oral mucosa may develop erosions and pustules without a linear pattern [5]. The linear nature of the dermatitis has been attributed to the Koebner phenomenon, that results from a toxic reaction after trauma to the skin [4, 10]. It has been proposed that this koebnerization is due to high serum lentinan levels that

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Fig. 1 Whole shiitake mushrooms (*Lentinula edodes*)



Fig. 2 A 38-year-old man with flagellate erythematous papules on the trunk (*left*) and right upper extremity (*right*). Patient history was consistent with the diagnosis of shiitake mushroom dermatitis

activate leukocytes [10]. Patients may also complain of increasing pruritus when exposed to the sun or tanning beds [11]. Shiitake mushroom dermatitis has not thus far been associated with systemic manifestations.

Individuals such as harvesters who come into contact with shiitake mushrooms and their spores experience a different set of manifestations: an occupational dermatitis of the hands and respiratory distress that is most predominant during times of direct contact with the mushrooms [12]. Serologic testing of affected individuals has found elevated levels of shiitake-specific immunoglobulin (Ig)-G, suggesting this reaction is due to a protein contact dermatitis [13]. Prick testing for allergies in these individuals may be positive.

3 Etiology

Despite the growing number of cases reported globally, the pathophysiology responsible for shiitake mushroom dermatitis remains unclear. The polysaccharide lentinan was originally believed to be the cause of the dermatitis; this hypothesis stemming from its effects in the human body and heat lability.

Lentinan is a beta-glucan polysaccharide found in shiitake mushrooms and has been used as an adjunct treatment for gastric cancer in Japan since 1985 [3]. This benefit is reported to be due to in vivo activation of macrophages and monocytes in human cell lines [14]. Lentinan may cause shiitake dermatitis by inducing an immunomodulatory effect in monocytes and macrophages, leading to a toxic cutaneous reaction. Along with its effects on human cell lines, lentinan is also heat labile. When shiitake mushrooms are properly heated, lentinan is denatured and no ill effect is noted after consumption. If shiitakes are consumed while raw or undercooked, the lentinan in the mushrooms retains its activity.

An alternative causal agent may contribute to shiitake mushroom dermatitis. It has been proposed that this molecule may be a complex heat-stable polysaccharide similar to lentinan [4]. This hypothesis stems from reports of the characteristic flagellate dermatitis after consumption of fully cooked shiitakes [15]. Further supporting this hypothesis is that patients treated with lentinan for gastric cancer rarely develop shiitake dermatitis despite the systemic administration of the polysaccharide [4].

4 Epidemiology

Shiitake dermatitis was initially observed only in East Asia, where the mushrooms were cultivated and consumed at a higher rate than in other areas of the world. The first reported case outside this endemic region was in Finland in 1998 [16]. Since then, numerous cases have been seen outside of East Asia, including countries in Europe, South America, North America, and southern Asia [4–11, 15, 17–45].

5 Diagnosis

The patient's history should provide the information necessary to confirm a diagnosis of shiitake mushroom dermatitis. If the characteristic physical findings suggest shiitake dermatitis, careful questioning regarding recent

ingestion of shiitake mushrooms may lead to the correct diagnosis. Physicians should also inquire about the method of mushroom preparation and a specific time frame of ingestion, as the eruption appears 24–48 h after consumption of the shiitakes. If patients deny knowingly ingesting shiitakes, physicians should enquire about the use of herbal supplements, as mushroom supplements may contain shiitake extract, which consumers may not realize.

There appears to be no formal diagnostic testing for shiitake dermatitis resulting from the consumption of undercooked shiitakes. This is because the diagnosis is made based on the history when presented with the characteristic dermatitis. Patients undergoing scratch or prick-to-prick testing have been reported as demonstrating a cutaneous reaction 24–72 h after exposure to shiitake extract, whereas control patients have demonstrated no reaction in these cases [17, 30].

Patients with symptoms consistent with contact dermatitis who have been in contact with shiitakes or their spores can undergo serologic tests to detect shiitake-specific IgG binding with extract [13]. It has also been reported that patients with contact dermatitis may have IgE antibodies to shiitake upon serologic testing, but the nature of the protein dermatitis does not appear to manifest as an immediate-type hypersensitivity reaction [12].

6 Differential Diagnosis

The differential diagnosis of shiitake mushroom dermatitis includes other flagellate cutaneous eruptions such as drug reactions to the chemotherapeutics bleomycin and trastuzumab, phytophotodermatitis, contact dermatitis, dermatographism, and adult-onset Still's disease. Flagellate eruptions secondary to chemotherapeutics should be readily identified by review of current medications. Adult-onset Still's disease is first evident with spiking fevers and arthralgias with cutaneous manifestations. Although the rash of adult-onset Still's disease is characteristically described as a 'salmon' rash, it can also be a flagellate eruption. Ferritin levels are markedly elevated in these individuals, and this laboratory finding may be confirmatory. Phytophotodermatitis is another clinical entity that may resemble shiitake dermatitis. This reaction may result from exposure to several types of plants that contain furocoumarin isomers, such as 8-methoxypsoralen. Meadow grass dermatitis is a phototoxic reaction to wild parsnip with an often striking crisscross pattern with linear excoriations and pruritus [46]. One potential distinguishing characteristic separating shiitake dermatitis from phytophotodermatitis is that the eruption appears in areas of direct contact, meaning that individuals typically present with excoriations on the extremities with sparing of the

torso if clothing was worn at the time of exposure. These lesions tend to blister, a characteristic that is not seen in shiitake mushroom dermatitis, but may assume a digitate pattern when an individual rubs his or her back on grass containing this plant. Contact dermatitis can initially be suggestive of shiitake mushroom dermatitis. Blistering is also characteristic of these lesions, which can help differentiate it from shiitake dermatitis. Dermatographism appears within minutes after the initial insult to the skin and lasts for minutes to hours, whereas the excoriations from shiitake dermatitis will persist for several days. If dermatographism is suspected, inducing cutaneous symptoms may help distinguish between dermatographism and shiitake mushroom dermatitis.

7 Histology

Histopathologic analysis is not diagnostic, but shiitake mushroom dermatitis will demonstrate spongiosis as well as superficial cuff-shaped perivascular lymphocytic dermal infiltration (Fig. 3) [6, 18, 35, 45].

8 Treatment

Shiitake dermatitis may be treated with topical corticosteroids or oral antihistamines [8, 45].

Patients with pulmonary symptoms and contact dermatitis to shiitakes should be counseled on methods to avoid inhalation of spores from the mushrooms. Those at risk should be advised to either wear a mask during times of exposure or completely avoid the mushrooms and their

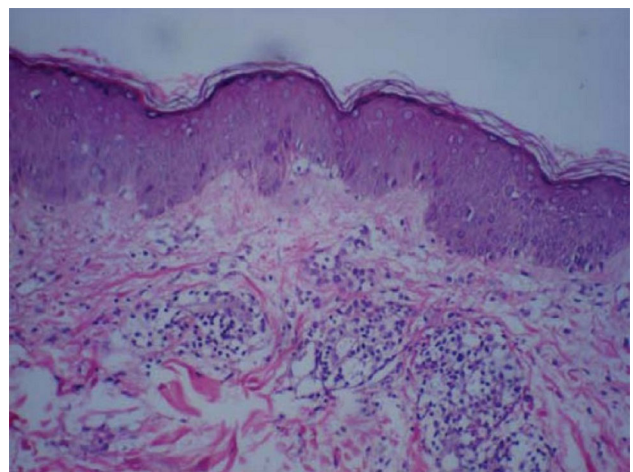


Fig. 3 Shiitake dermatitis demonstrating spongiosis and lymphocytic infiltration of the dermis. The epidermis is intact with dermal papillary edema [18]. Used with permission under Creative Commons Attribution License

spores [12]. Patients with an occupational dermatitis to shiitakes should be instructed to wear gloves or other barriers to avoid direct contact with the mushrooms.

9 Prognosis

Shiitake mushroom dermatitis usually resolves within 8 weeks. All individuals should take special precautions to ensure that shiitakes are fully cooked prior to ingestion. To our knowledge, no long-term sequelae to the affected areas, such as hyperpigmentation, hypopigmentation, or scarring, have been associated with this cutaneous eruption.

10 Conclusion

Given the evolving global food industry and ease of travel, the incidence of shiitake mushroom dermatitis is likely to increase. This cutaneous eruption is exquisitely pruritic. Early recognition with proper management and counseling should provide symptomatic relief and prevention of future episodes.

Compliance with Ethical Standards

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