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Delayed Allergic Reactions to Jellyfish Stings

Usefulness of Ultrasonographic Evaluation

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Jellyfish stings often cause immediate local skin reactions, and, less frequently, the affected individuals may develop delayed allergic reactions days or months after the sting. Here, we present 4 such cases. In all cases, color Doppler ultrasonography was performed at the time of diagnosis, and in 3 of the cases, clinical follow-ups with ultrasonographic evaluations were performed. Ultrasonography initially showed dermal thickening with decreased echogenicity that progressively normalized during follow-up. Ultrasonography was useful in quantifying inflammation by measuring the thickness of the dermis and was more precise than standard clinical follow-up of cutaneous lesions in these cases.

Key Words—delayed allergic reactions; jellyfish; sting; ultrasound; ultrasonography

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Abbreviations

CDUS, color Doppler ultrasonography; DAR, delayed allergic reaction; US, ultrasonography

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Jellyfish are free-floating, dome-shaped aquatic organisms. Their tentacles contain numerous nematocysts that release toxins triggered by contact. Although jellyfish stings may cause severe systemic symptoms, they often cause only immediate local skin reactions, which are usually characterized by erythema, swelling, vesicles, and intense localized pain.¹ Less frequently, affected individuals may develop delayed allergic reactions (DARs) with similar local symptoms.² Skin necrosis has been described in a few cases of DARs.³

A DAR to jellyfish stings is a clinical entity characterized by development of eczematous lesions days or months after contact with the jellyfish. While the immediate reaction is toxin mediated, an immune mechanism is responsible for the delayed eruptions.² The treatment goal is to ameliorate the local symptoms/signs, prevent further nematocyst discharges, and avoid systemic manifestations. Recommendations for managing acute local reactions are to wash the area of the sting with salty water or bicarbonate during the first minutes and then to scrape the affected skin.¹ The use of nonsteroidal anti-inflammatories may be helpful for pain control. In severe acute or delayed reactions, the use of systemic antihistamines, topical/oral corticosteroids, or tacrolimus ointment may be helpful.^{2,4,5}

Color Doppler ultrasonography (CDUS) is an imaging technique that has been used increasingly in dermatologic practice during the past few years.⁶ To date, we have not found articles describing the usefulness of CDUS in patients with jellyfish stings. We believe CDUS may be helpful in monitoring patients with DARs. Here, we

present 4 cases of DAR resulting from jellyfish stings in which CDUS evaluation was performed.

Methods

Patients with DARs caused by jellyfish stings who were seen from June 1 to September 30, 2016, in a Spanish tertiary hospital were included in this study. The protocol was approved by the hospital Ethics Committee. All patients provided oral and written informed consent.

The same protocol was applied to all patients, consisting of the following elements: In the areas affected by a DAR caused by jellyfish stings, Doppler ultrasonography (US; MyLab Class C system with an 18-MHz probe; Esaote SpA, Genoa, Italy) was performed, and the skin lesions were then biopsied. A clinical and CDUS-based follow-up was also performed.

All of the US examinations were performed by following the published guidelines for studying dermatologic lesions, which include grayscale and color Doppler imaging.⁷

Ultrasonographic measurements were obtained throughout the lesion and compared to healthy perilesional skin. The highest values of dermal thickness in the affected skin were compared to those obtained in the follow-up US. Color Doppler US with the power

Doppler mode was useful to detect low blood flow in the skin lesions. In 3 of the 4 cases, US monitoring was performed after 2 to 3 weeks of follow-up.

Case Descriptions

Four patients were included, and in all cases CDUS was performed at the time of diagnosis; in 3 of the cases, clinical follow-up with subsequent US evaluations and biopsy of the affected area was carried out. Treatment differed among patients depending on the severity of symptoms. Table 1 describes US characteristics before and after treatment and histologic findings.

Case 1

The patient was a 38-year-old woman. She had been stung by a jellyfish 21 days before being seen. Immediately after the sting, she cleaned the area with tap water and applied an ethanol-based hand sanitizer. She remained asymptomatic with no cutaneous lesions until 3 weeks later, when she developed a pruriginous eruption. Physical examination showed papular lesions in a linear distribution with a lichenoid appearance on the abdomen. She was treated with topical clobetasol daily for a week. After 3 weeks, only residual hyperpigmented

Table 1. Ultrasonographic and Histologic Findings in Patients Affected With DARs to Jellyfish Stings

Case	Initial CDUS	Control CDUS	Histologic Findings
1	Dermis thickened with decreased echogenicity (compared to normal dermis) in the affected area, measuring 6 mm (compared to a perilesional dermis of 2 mm); CDUS: hypovascularity	Dermis 2.1 mm thick in hyperpigmented area, with no difference from perilesional skin	Acanthotic hyperplastic epidermis with spongiosis and minimal exocytosis of lymphocytes; perivascular lymphohistiocytic infiltrate with numerous eosinophils in dermis
2	Dermis thickened in the affected area with decreased echogenicity (compared to normal dermis), measuring 4.3 mm (compared to a healthy perilesional dermis of 3.1 mm); CDUS: hypovascularity	Dermis in the affected area measured 3.1 mm	Spongiosis in the epidermis, interface dermatitis; marked edema and mixed inflammatory infiltrate with predominance of eosinophils in dermis
3	Dermis thickened with decreased echogenicity (compared to normal dermis), measuring 2.4 mm (compared to a perilesional dermis of 1.3 mm); CDUS: hypovascularity	Dermis in the affected area measured 2.0 mm	Spongiosis in the epidermis; perivascular lymphocytic infiltrate in dermis
4	Dermis thickened in the affected area with decreased echogenicity (compared to normal dermis), measuring 3.3 mm (compared to a perilesional dermis of 1.1 mm); CDUS: hypovascularity	No control	No biopsy

macules remained, and CDUS showed complete resolution of the lesions.

Case 2

The patient was a 71-year-old man who had been stung by a jellyfish 7 days earlier. Immediately after the sting, a lifeguard applied bicarbonate and ice to the area of the sting. He remained asymptomatic for 5 days, and then he developed a pruriginous rash. A physical examination showed an erythematous plaque on his back. He was then treated with prednicarbate 0.25% cream daily for 2 weeks, with complete resolution of skin lesions. Figure 1, A and B, shows the US changes during the patient follow-up.

Case 3

The patient was a 46-year-old man who had been stung 45 days before being seen. At the time, the lifeguard applied papain and allantoin. He had no cutaneous

lesions for more than a month but then developed a painful skin eruption on his chest. However, he deferred medical consultation for almost 15 days. On his arrival at the hospital, a physical examination showed brown linear lesions on the anterior aspect of the thorax. Treatment with emollients was indicated. Two weeks later, a clinical evaluation was performed, and the skin lesions had barely improved; however, CDUS showed that cutaneous involvement had reduced. After 2 more weeks of treatment with emollients, the skin lesions had completely resolved. Figure 2, A and B, shows the US findings in the area of the sting and in perilesional skin.

Case 4

The patient was a 24-year-old woman who had been stung by a jellyfish 10 days earlier. No topical treatment was applied at the time of the sting, and symptoms improved spontaneously within a few hours. However, 10 days later she developed pruritus, erythema, and

Figure 1. Ultrasonographic findings in patient 2 (affected with a DAR to jellyfish stings). **A**, Initial evaluation of the affected area: dermis thickened with decreased echogenicity (compared to normal dermis), measuring 4.3 mm. **B**, Two weeks later, dermis in the affected area measuring 3.1 mm.

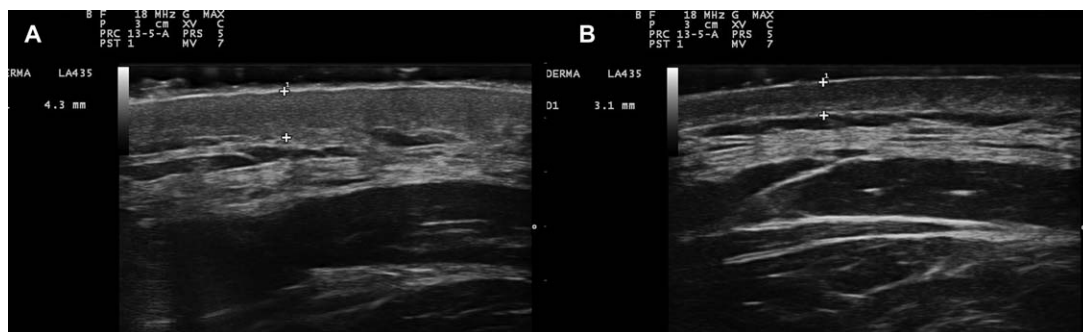
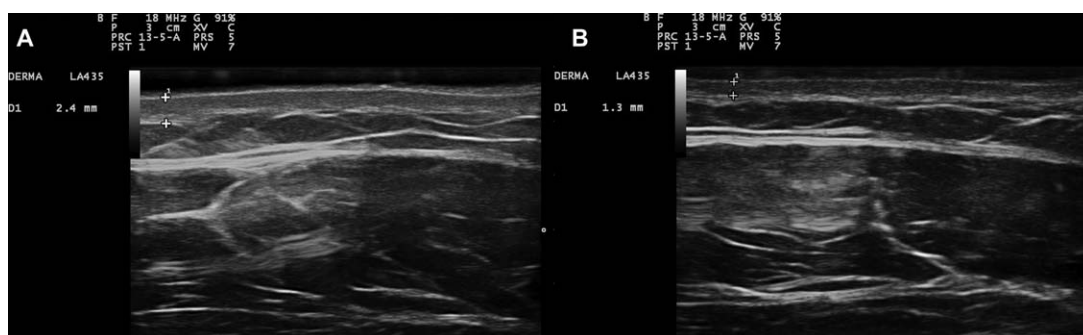


Figure 2. Ultrasonographic findings in patient 3 (affected with a DAR to jellyfish stings). **A**, Dermis thickened in the affected area with decreased echogenicity (compared to normal dermis), measuring 2.4 mm. **B**, Perilesional skin, dermis measuring 1.3 mm.



painful edema on her left leg. A physical examination showed an erythematous, edematous plaque on her leg. Treatment with betamethasone/gentamicin cream was given, and the patient did not return for follow-up.

Discussion

Color Doppler US is useful for assessing multiple inflammatory skin disorders such as psoriasis, systemic sclerosis, morphea, hidradenitis suppurativa, and cutaneous lupus erythematosus.⁸ Common US features of acute phases of skin inflammation are low echogenicity and increased dermal thickness, as well as increased vascularization on the color Doppler mode, while fibrosis is mostly associated with dermal thinning and increased echogenicity.^{8,9} Another cause of a hypoechoic dermis is photoaging (or photodamage) caused by sun exposure.⁸ The role that CDUS can play in monitoring disease activity and in the evaluation of the response to therapy has been reported in several inflammatory and infectious cutaneous disorders.^{10–12} However, to our knowledge, US assessment of DARs caused by jellyfish stings has not been described to date.

In all 4 cases described in this series, the initial CDUS showed a dermal thickening with decreased echogenicity compared to the dermis of healthy individuals, as the normal dermis is hyperechoic.⁸ Dermal thickening had normalized by the CDUS-based follow-up visit. In some of our patients, the perilesional dermis (Figure 2B) or the dermis on follow-up (Figure 1B) was hypoechoic. This could have been due to photoaging.⁸ It is noteworthy that CDUS allowed the treating physician to ascertain that skin inflammation had remitted and therefore to suspend treatment, even when clinical evaluation of the skin lesions remained almost unchanged. We detected hypovascularization with the Doppler mode. This could have been related to vasoconstriction associated with jellyfish stings or limitations in the Doppler mode of our equipment. The use of color or power Doppler imaging is crucial to rule out vessel contraction disorders potentially leading to ischemia, such as severe vasospasm induced by jellyfish stings.^{13,14}

In conclusion, most patients affected by jellyfish stings show immediate symptoms, which usually resolve within a few minutes or hours. However, delayed clinical presentation is also possible, and clinicians should be

aware of it. In the short series of patients presented here with delayed DARs caused by jellyfish stings, CDUS was shown to be useful in improving clinical evaluation and follow-up. Dermal thickening was the most common US finding.

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