

Epidemiology of jellyfish stings reported to summer health centres in the Salento peninsula (Italy)

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Background: The presence of jellyfish along coasts constitutes a potentially serious public health problem because of the toxic effects of contact with them.

Objective: To determine the epidemiology of jellyfish stings in the Province of Lecce, Italy, in 2007.

Methods: The study involved the gathering and processing of data on patients seeking medical treatment at summer first aid centres and hospitals along the coast of Salento following contact with jellyfish.

Results: In 2007, 446 bathers sought medical assistance following contact with jellyfish. The spatial distribution indicates a greater frequency of stings sustained along the Adriatic coast, while the time analysis shows patterns related to wind direction. Most of the injuries were seen in persons aged between 1 and 10 years and in females. In 24% of cases, injuries were sustained to several parts of the body, while single injuries were mainly to the lower limbs (33%). In 4.9% of cases, there were complications, including one case of anaphylactic shock.

Conclusion: In the light of the significant level of medical assistance provided, there is a need to identify suitable strategies that will guarantee the best response in terms of both prevention and treatment.

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The presence of jellyfish along coasts constitutes a potentially serious public health problem because of the possible toxic effects of contact with them. Many jellyfish have a highly evolved stinging system, which causes varying degrees of harm to human skin (1). The surface of their bodies and tentacles is covered in highly specialized cells called cnidocytes or cnidoblasts (2, 3), the cytoplasm of which contains a nematocyst, a capsule full of stinging fluid that is injected into the human skin when stimulated by contact (4, 5).

The poison is a complex blend of molecules including histamine, imidazole acetic acid, and 5-hydroxytryptamine, which contribute to skin damage, and tetramine, which induces paralysis. In addition, toxic systemic effects are caused by various proteins including hypnotoxin, thalassin,

congestin, hyaluronidase, collagenase, protease, nuclease, and phosphatase.

The pathogenesis of reactions to the sting of these Cnidarians can be both toxic and allergic (6, 7). Cutaneous contact with a jellyfish induces an instantaneous localized pain after which wheals appear (8). Cutaneous reactions are sometimes accompanied by toxic systemic symptoms (1, 9). Allergic reactions are dose independent, require previous exposure to the venom (10), and range from recurrent raised wheals to anaphylactic shock.

Of the species present in the Mediterranean, the dermatotoxicity of *Pelagia noctiluca* is well known (11–14); *Rhizostoma pulmo* (11, 15, 16) can cause dermatitis, while the dermatotoxicity of *Aurelia aurita* (11) is uncertain. Also the

toxic effects of *Chrysaora hysoscella* (11, 17–19), *Carybdea marsupialis* (20, 21), *Physalia physalis* (22), and *Rhopilema nomadica* (23, 24) have been demonstrated.

Treatment of jellyfish stings is still fundamentally symptomatic and non-specific (except for *Chironex fleckeri*, for which there is a specific antivenom). Depending on the seriousness of the case, it consists of deactivating the nematocysts, reducing the pain, local and/or systemic treatments, and support for vital organs in the case of complications.

Traditional but still valid remedies, designed to alleviate symptoms, used by fishermen, inhabitants of coastal cities, and bathers 'accustomed' to contact with Cnidaria, involve application of vinegar, ammonia, urine, formaldehyde, hot water, or ice. These treatments are often sufficient to contain the toxic reaction and pain. It is not uncommon, however, for victims to seek medical assistance in first aid stations and emergency wards, especially in the case of more extensive wounds or stings to the mucous membranes or when the sufferers are children.

The aim of this study was to analyse the epidemiology of jellyfish stings in the Province of Lecce in the 2007 bathing season in order to estimate the presence of these organisms along the coast of the Salento and assess its socio-health implications.

Materials and Methods

The study was conducted in collaboration with the Local Health Authority of Lecce (Azienda Sanitaria Locale/Lecce or ASL/LE), which involved the gathering of data relating to persons seeking medical treatment following contact with jellyfish.

The registers of medical assistance provided in the months of July and August at first aid centres and hospitals along the coast of the Province of Lecce (Fig. 1) were examined. As shown in detail in Table 1, 19 summer first aid centres set-up by ASL/LE in the months of July and August and organized by the relevant health districts were considered, together with the emergency wards of the four hospitals in the province's coastal municipalities.

The hospitals and first aid centres were then subdivided into three groups based on geographical area:

- (1) Adriatic coast (1–6).
- (2) Lower Ionian coast (7–18).
- (3) Upper Ionian coast (19–23).

Data were drawn regarding the age, sex, and provenance of the patients, the date and time of the assistance provided, the place where they had

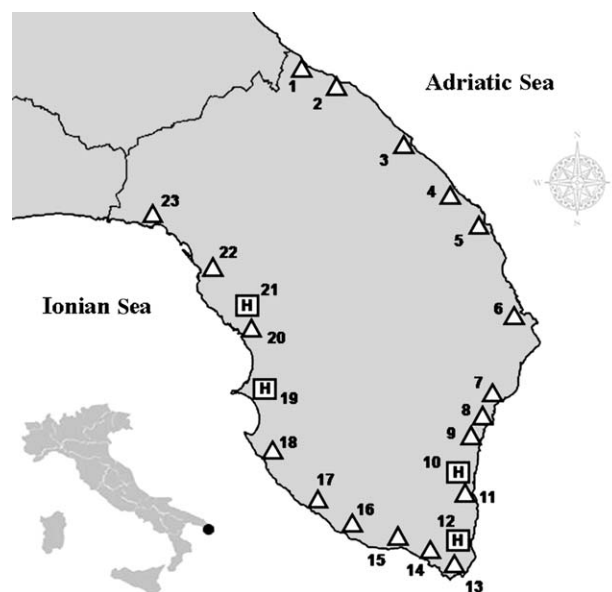


Fig. 1. Health centres along the coast of the Province of Lecce (Δ = Summer first aid centre, $\square$ = Hospital).

been bathing, the location and type of lesion sustained, the treatment performed, and any complications.

The acquired data were inserted in a spreadsheet (MICROSOFT EXCEL 2007) and subsequently processed.

To better evaluate the temporal trend, the period of study was subdivided into four parts of about 2 weeks each: 1–15 of July, 16–31 of July, 1–15 of August, and 16–31 of August.

The patients receiving care were grouped into the following age bands: 1–10, 11–20, 21–30, 31–40, 41–50, 51–60, and >60 years.

Regarding patients' geographical provenance, the subjects were subdivided into three groups: 'residents of the Province of Lecce', 'residents of other Italian provinces', and 'foreign residents'.

Results

The treatment registers of the health centres along the coast of the Province of Lecce showed that in the period between 1 July and 31 August 2007, 446 bathers sought medical assistance following contact with jellyfish.

The greatest number of cases, 329 or 74% of the total, were recorded along the Adriatic coast, while the upper and lower Ionian coasts accounted for the remaining 26% (Fig. 2).

Along the Adriatic coast, the frequency of cases increased over the period (Fig. 3), from 4 in the first half of July to 198 in the second half of August. In contrast, along the upper and lower Ionian coasts, the frequency was highest from 1 to 15 July (18 and 25 cases, respectively).

Table 1. Health centres along the coast of the Province of Lecce showing health district and geographical area

	Location	Health centre	Health district	Coast
1	Casalabate	SFAC	Lecce	Adriatic
2	Torre Chianca	SFAC	Lecce	Adriatic
3	San Cataldo	SFAC	Lecce	Adriatic
4	Torre Dell'orso	SFAC	Martano	Adriatic
5	San Foca	SFAC	Martano	Adriatic
6	Otranto	SFAC	Maglie	Adriatic
7	Santa Cesarea Terme	SFAC	Poggiardo	Lower Ionian
8	Castro	SFAC	Poggiardo	Lower Ionian
9	Marina di Andrano	SFAC	Poggiardo	Lower Ionian
10	Tricase	H	Gagliano del Capo	Lower Ionian
11	Tricase Porto	SFAC	Gagliano del Capo	Lower Ionian
12	Gagliano	H	Gagliano del Capo	Lower Ionian
13	Marina di Leuca	SFAC	Gagliano del Capo	Lower Ionian
14	Torre Vado	SFAC	Gagliano del Capo	Lower Ionian
15	Lido marini	SFAC	Gagliano del Capo	Lower Ionian
16	Torre san Giovanni	SFAC	Gagliano del Capo	Lower Ionian
17	Torre Suda	SFAC	Gagliano del Capo	Lower Ionian
18	Mancaversa	SFAC	Gallipoli	Lower Ionian
19	Gallipoli	H	Gallipoli	Upper Ionian
20	Santa Maria al Bagno	SFAC	Gallipoli	Upper Ionian
21	Nardò	H	Nardò	Upper Ionian
22	Sant' Isidoro	SFAC	Nardò	Upper Ionian
23	Torre Lapillo	SFAC	Nardò	Upper Ionian

H, hospital; SFAC, summer first aid centre.

Regarding age, lesions were most frequent in individuals aged between 1 and 10 years, which accounted for 25% of cases. These were followed by the 11–20 years age group, who accounted for 23%. The frequency of stings among individuals aged between 21 and 30 years was 20% and 15% in the group aged between 31 and 40 years. The other age groups were affected less frequently (Fig. 4).

As for sex, a slim majority of those seeking treatment were female (54%) with the greatest differences seen in subjects up to 40 years old.

The data on the provenance of the subjects showed that 59% of the individuals seeking treatment were 'resident' in the Province of Lecce, while

the remaining 41% of cases were presumed to be tourists, of which 3% were from other countries.

Regarding parts of the body affected by stings (Fig. 5), 'multiple stings' resulting from contact with jellyfish tentacles on various parts of the body accounted for 24% of cases. In most of the remaining 76% of cases, the stings were on the lower limbs (33%) and upper limbs (22%). Many subjects also sought medical assistance for stings to the face (16%).

In the majority of cases, the symptoms were not severe, being confined to local and cutaneous reactions, characterized by pain, intense burning, raised welts, and blisters but without systemic effects. In 4.9% of cases, however, there were

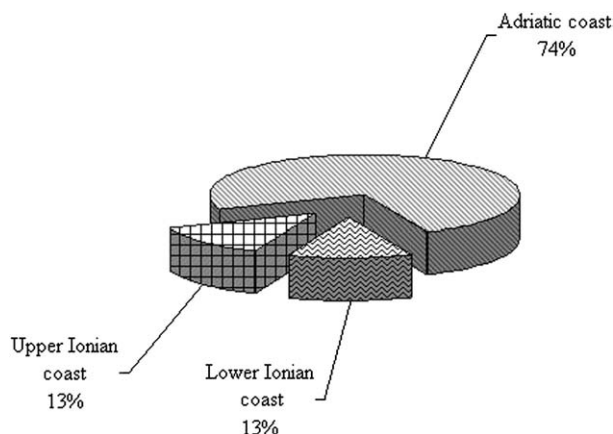


Fig. 2. Spatial distribution.

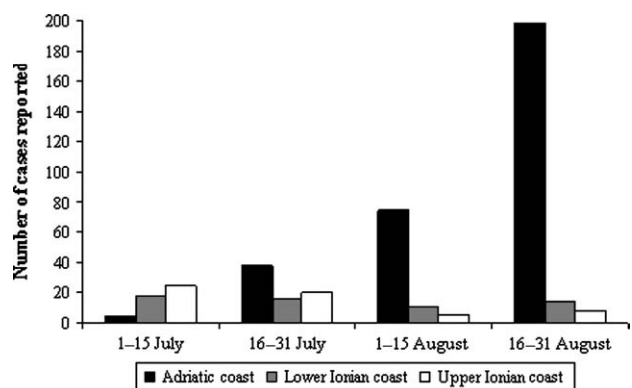


Fig. 3. Spatial and temporal distribution.

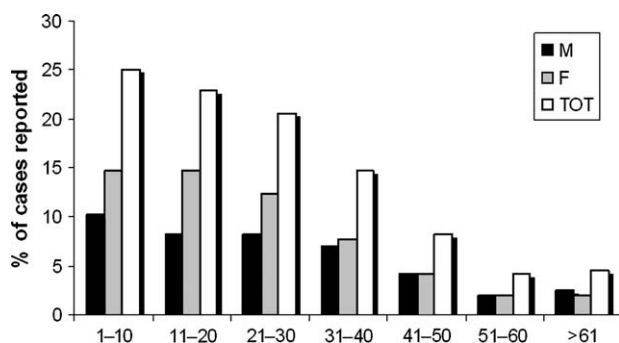


Fig. 4. Distribution of cases in relation to sex and age.

complications (Table 2), mainly allergic reactions (2.2%). There was even a case of anaphylactic shock in which the patient was immediately taken to hospital by ambulance. The other complications included ocular oedema resulting from a jellyfish sting to the eye (1.1%), urticaria (0.4%), muscular spasms (0.4%), and conjunctivitis (0.4%).

The treatment carried out by the medical personnel typically entailed the use of corticosteroids, both systemic (58%) and locally applied (41%). Systemic antihistamines were administered in 33% of cases and locally applied antihistamines in 2%. Systemic corticosteroids and antihistamines were administered in combination in 27% of treatments. In 4% of cases, anti-inflammatory agents or analgesics were used, while 5% involved specific treatments.

Non-pharmacological treatments (27%) mainly consisted of rinsing with ammonia (59.3%) or application of soothing creams (11.1%), alcohol (7.4%), and ice (3.7%).

Discussion

This epidemiological study indicates that along the coasts of the Salento peninsula, a relatively high number of individuals sought medical care at hospitals and clinics in the months of July and August 2007 following jellyfish stings.

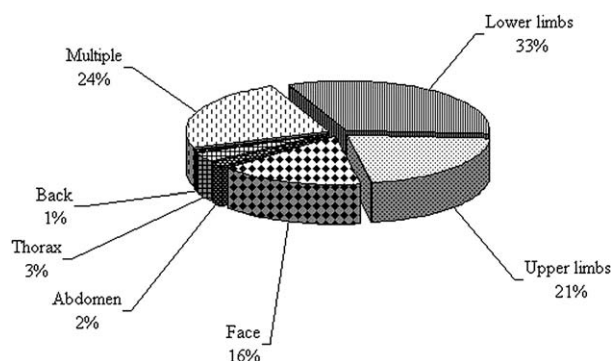


Fig. 5. Location of lesions.

Table 2. Complications arising after contact with jellyfish

Complication	n (%)
Anaphylactic shock	1 (0.2)
Allergic reaction	10 (2.2)
Ocular oedema	5 (1.1)
Conjunctivitis	2 (0.4)
Urticaria	2 (0.4)
Muscular spasms	2 (0.4)
Total	22 (4.9)

The distribution of the subjects affected shows a greater number of incidents along the Adriatic coast than the Ionian. This is probably because of various factors including the particularly high density of bathers along the sandy beaches of the northeastern coast of the Province of Lecce and the different currents between Adriatic and Ionian seas.

In line with observations made by Forrester (25), a relatively higher number of individuals seeking medical treatment were from the younger age groups, particularly the 1–10 years group, which include those subjects most sensitive to the irritant properties of jellyfish.

Concerning sex, although men tend to be more exposed to contact with jellyfish than women because they take part more frequently in water sports (surfing, sailing, swimming, scuba diving, etc.) (26), the venom has more pronounced effects on the skin and bodies of women (27). This observation and the apprehension that the stings may have consequences of an aesthetic nature (scars or other lasting signs) may explain the higher frequency of women among the patients treated at the health centres along the coast of the Salento.

Observing the data concerning the part of the body affected by the jellyfish stings, it emerges that in most cases (67%), contact occurred in points that suggest that the subject was completely immersed in water at the time (multiple stings and stings to the upper limbs, face, chest, and abdomen). In contrast, stings to the lower limbs alone (33%) presumably affected persons standing in shallow water.

The effects of the stings can vary from a light burning sensation and reddening of the skin to intense pain, severe cutaneous lesions, and deterioration of the patient's general state of health. This depends on the age and physical condition of the individual, the sensitivity of the area affected by the lesion, and the species responsible for the sting. In most cases, the registers of the Salento health centres considered here describe mild reactions, exclusively local and cutaneous, characterized by pain, burning sensation, raised welts, and blisters but with no systemic effects.

However, in a significant number of cases (4.9%, which is high considering the generally low risk associated with Mediterranean jellyfish species), complications arose in the form of allergic reactions, systemic symptoms, local consequences (conjunctivitis and ocular oedemas), and even a case of anaphylactic shock in which the patient was immediately taken to hospital by ambulance.

Regarding the medical treatment of the lesions caused by contact with jellyfish, the data gathered do not point to a standardized therapeutic protocol applied at the ASL/LE health centres. Indeed, it appears that the care provided consists mostly of general treatment (especially ammonia, ice, and soothing ointments, used to reduce the pain and the burning sensation by partially deactivating the toxins), corticosteroids, and antihistamines depending on the seriousness of the case. Locally applied and systemic corticosteroids were frequently used. In some cases, recourse to anti-inflammatory agents, analgesics, antibiotics, and specific treatments was necessary.

As well as being a public health problem, the presence of jellyfish has a negative impact on other sectors including tourism. Our study shows, for example, that a large number of the bathers seeking medical attention were tourists (41%). The number of resident victims of jellyfish stings is probably much higher, but the local population is assumed to be more accustomed to the occasional appearance of these creatures and thus less alarmed by contact with them and is in any case capable of self-treatment. Residents of other areas of Italy or Europe may be more susceptible to the psychological impact of jellyfish stings.

The data analysed in this study indicate that in the light of the significant level of medical assistance sought and provided, even in regions where the appearance of jellyfish has never given rise to serious health scares, there is a need to identify suitable strategies that will guarantee the best response in terms of both prevention and treatment.

First, the seasonal coastal health centres need to be maintained and enhanced, extending their period of operation to include June and September. This is consistent with the stated policy of 'deseasonalizing' tourism, which seeks to make the coast of the Salento a destination for bathers even in what has traditionally been considered the low season. To guarantee the maximum quality of medical assistance, it could be useful to adopt standardized treatment protocols so as to enable rapid intervention of both a generic and a specific kind.

Also advisable would be an education and awareness programme to inform bathers about how to behave when jellyfish are seen in the waters

and in the case of contact with them in order to lighten the pressure on local health structures.

Thus, a continuous surveillance programme for the presence of jellyfish along the coast and offshore should be useful, especially if operating all year. This would also assess factors that condition their biology, dynamics, and ecology in order to carry out a proper estimate of the phenomenon and to prepare appropriate measures to tackle any blooms.

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