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## Risk Factors for Seabather's Eruption: A Prospective Cohort Study

### SYNOPSIS

**Objective.** A prospective cohort study was performed to identify risk factors for seabather's eruption.

**Methods.** Study participants were recruited at four beaches in Palm Beach County, Florida, during three weekends of May and June 1993. Participants were interviewed by telephone after 48 hours regarding medical history, beach activities, development of rashes, and use of possible preventive measures.

**Results.** Seabather's eruption, defined by the occurrence of a rash within two days of exposure to seawater, was reported by 114 (16%) of 735 respondents. The strongest predictor of seabather's eruption was a past history of the condition. Children less than 16 years of age were also at increased risk, as were surfers. Showering with one's bathing suit off was a useful protective measure.

**Conclusion.** The study's findings suggest that when the seasonal risk of seabather's eruption is present, children, people with a history of seabather's eruption, and surfers are at greatest risk. During the sea lice season, seabathers can minimize their risk by showering with their bathing suits off after seabathing. Length of the time spent in water was not significantly associated with seabather's eruption.

Seabather's eruption, commonly known as "sea lice," has been documented since the early 1900s in reports from the southeastern and western coasts of Florida.<sup>1,2,3,4</sup> Seabather's eruption typically presents as a pruritic rash, usually within 24 hours of exposure to seawater.<sup>5,6,7</sup> It primarily affects areas covered by bathing suits and can be especially severe in young children, who may have high fever and other systemic symptoms. The seabather's eruption season is from March to August but is at its worst in May, when attack rates in bathers are at their peak.<sup>8,9</sup> The incidence of seabather's eruption in South Florida appears to have increased in recent years.<sup>5,8,9</sup>

Seabather's eruption is believed to be the result of a hypersensitivity, that is, an allergic reaction, to the larval form (planulae) of the thimble jellyfish *Linuche unguiculata*.<sup>10,11</sup> Some researchers have suggested that discharge of venom may be promoted by mechanical stimulation or exposure to fresh water.<sup>11,12,13</sup> It has also been suggested that bathing suits act as filters to trap planulae near

**Comparison between people who did and did not contract seabather's eruption, four Florida beaches, May and June 1993 (N=735)**

Variable	People with Seabather's Eruption n=114		People without Seabather's Eruption n=621		Risk Ratio	95% CI	P value
	Number	Percent	Number	Percent			
Past history of seabather's eruption. . . .	71	62	139	22	4.13	2.93, 5.82	<10 <sup>-8</sup>
Less than 16 years of age. . . . .	59	52	134	22	3.01	2.17, 4.18	<10 <sup>-8</sup>
Surfed . . . . .	22	19	32	5	3.02	2.08, 4.38	<10 <sup>-6</sup>
Snorkeled . . . . .	10	9	20	3	2.26	1.32, 3.86	<0.01
Showered > 1 hour after swim . . . . .	39	34	280	45	0.68	0.47, 0.97	.03
Showered at the beach . . . . .	74	65	320	52	1.60	1.12, 2.29	.008
Showered with bathing suit off . . . . .	35	31	284	46	0.58	0.40, 0.84	.003

CI = confidence interval

the skin, where they discharge a venom that produces an allergic response.

Anecdotal reports suggest that various creams or ointments may be protective and that showering and/or towel drying immediately after bathing may remove trapped planulae.<sup>14</sup> Some studies have shown that increased risk of seabather's eruption is associated with allergies or a history of previous seabather's eruption.<sup>14,15</sup>

Previous epidemiological descriptions of seabather's eruption have been based on case reports. This study was done to clarify risk factors and to evaluate possible preventive measures.

**Methods**

This was a prospective cohort study. All people visiting one of four beaches in Palm Beach County, Florida, on May 22-23, June 5-6, and June 13, 1993, were eligible to participate. Interviewers approached people on the beaches between the hours of 11 a.m. and 4 p.m. and obtained informed consent from those who agreed to participate. Participants provided names, addresses, and telephone numbers and indicated a time 48 hours later when a follow-up interview by telephone would be convenient. Repeated attempts to interview were made when necessary, up to 10 days after the beach visit. Supervising adults provided consent and information on children. A standardized questionnaire was used for follow-up interviews to obtain information regarding the occurrence of rash, suspected risk factors, and possible protective measures. Subjects reporting no exposure to seawater were excluded from the analysis. A case of seabather's eruption was defined by the occurrence of a macular rash within two days of exposure to seawater.

Plankton samples were collected from each site to measure the concentrations of *Linuche* planula larvae. Each plankton sample consisted of three replicate two-minute tows taken parallel to shore. The Division of Marine

Biology, University of Miami, performed microscopic observation of the plankton and counted the number of planulae in subsamples of the tow material. Numbers of planulae were then adjusted by the fraction of the total sample analyzed and the volume of water filtered during each tow (as estimated by the flow-meter in the mouth of the plankton net) to yield numbers of planulae per cubic meter.

Univariate and stratified analyses of study data were performed using EpiInfo (version 6.0) statistical software.<sup>16</sup> Factors with a significant association with the rash on univariate analysis (two-tailed, *P*<0.05) were entered into a multiple regression model. This model, with seabather's eruption as the dependent variable, was analyzed by unconditional logistic regression using Epilog statistical software.<sup>17</sup>

**Results**

Concentrations of *Linuche* planula in Palm Beach inshore waters ranged from 0 to 171 planula per cubic meter, with most of the samples having less than 20 per cubic meter. The concentrations were similar for the four study beaches.

A total of 1304 people agreed to participate in the study, and follow-up interviews were completed for 782 (60%). The study cohort consisted of the 735 respondents who reported that they had at least 10 minutes' exposure to seawater. The study group were similar in age, sex, and exposure patterns across the four beaches. The mean age of cohort members was 30 years (SD 18.9, range 1-80 years), 97% were white, and 54% were female.

Seabather's eruption was reported by 114 (16%) cohort members: 56 males and 58 females. The seabather's eruption attack rates were remarkably consistent among the three weekends (range: 15% to 16%) and at each of the four beach locations (range: 15% to 16%). Cohort members reporting seabather's eruption were younger (mean age 20 years,

median 15, range 2 to 76) than those who did not report seabather's eruption (mean age 32 years, median 32, range 1–80;  $P < 10^{-5}$ ).

The onset of seabather's eruption was on the same day as seabathing for 68% of the respondents, the following day for 26% and the second day for 6%. Rashes were reported to have appeared on all parts of the body but were most common in males on the buttocks (45%), abdomen (43%), and groin (41%). In females, the most common sites were the chest (52%), abdomen (40%), and buttocks (34%). Females with seabather's eruption who wore one-piece bathing suits were more likely than those in two-piece suits to report rashes on their abdomens ( $p < 0.01$ ). In 85% of cases, the rash was pruritic. Constitutional symptoms were reported in only 10 cases (9%): seven cases of fever, five of nausea, and three of body aches. These symptoms occurred exclusively in children and adolescents (mean age 8.6 years, range 4–17).

**Risk factors.** Factors found to be associated with seabather's eruption by univariate analysis are shown in Table 1. Factors found to have no significant association with seabather's eruption included a history of allergies; bathing suit style or material; the application of ointments, creams or lotions before seabathing; towel drying after seabathing (before showering); and shower temperature. A slightly greater proportion of people with seabather's eruption than those without spent over an hour in the water, but the difference was not statistically significant (13% versus 8%, RR = 1.54; 95% CI 0.95, 2.48;  $P = 0.09$ ). Both people who surfed and those who snorkeled were more likely than others to have spent more than one hour in the water.

When all of the risk factors found significant by univariate analysis were entered into a multiple logistic regression model, only the following remained significant predictors of seabather's eruption: a past history of seabather's eruption (OR 6.29; 95% CI 3.80, 10.42;  $P < 10^{-4}$ ), age less than 16 years (OR 4.17; 95% CI 2.51, 6.87;  $P < 10^{-4}$ ), and surfing (OR 2.83; 95% CI 1.35, 5.41;  $P < 0.01$ ).

Exclusion of past history and age from the multiple logistic regression model permitted analysis of behavioral factors amenable to change. The results showed that surfing was associated with increased risk (OR 3.82; 95% CI 1.97, 7.50;  $P < 0.001$ ) and showering with bathing suit off was significantly protective (OR 0.45; 95% CI 0.23, 0.90;  $P < 0.02$ ) regardless of length of time in the water or the timing of showers.

## Discussion

Our findings show that when the seasonal threat of seabather's eruption is present, children, people with a history of seabather's eruption, and surfers are at greatest risk and that showering with one's bathing suit off is protective. These findings support an earlier observational study which suggested that the risk of seabather's eruption could be reduced by removing bathing suits before showering.<sup>15</sup> Our findings do not support the hypothesis that application of commonly used ointments, creams, or lotions before seabathing protects against seabather's eruption.<sup>13</sup>

The concentrations of *Linuche planulae* we found in bathing area waters were higher than 10 planulae per cubic meter of collected thimble jelly fish larva and support the role of *Linuche unguiculata* as the causative agent of seabather's eruption. *Linuche planulae* concentrations in seawater are highest in the weeks after spawning, when they typically reach levels of 1 to 10 per cubic meter.<sup>18,19</sup>

Our findings suggest that the incidence of seabather's eruption may be reduced by: (a) providing and encouraging the use of shower facilities where people can shower with their bathing suits off, and (b) advising bathers by posting sea lice warnings during the season.

Additional research is needed to develop tests that could be done at the beach to identify the presence of larvae of jellyfish so that seabathers may be informed of daily fluctuations in risk and advised when and how to avoid exposure.

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*EDITOR'S NOTE: We don't know whether it is obedience to social mores or a commercial link to fashion industry that has*

Seabather's eruption typically presents as a pruritic rash, usually within 24 hours of exposure to seawater.

## Scientific Contribution

*prevented the authors from suggesting an important preventive strategy for seabather's eruption in an otherwise excellent article. In the interest of good public health research and practice, we feel compelled to note that abandoning swimming garments altogether, usually referred to as "nude bathing" or "skinny dipping" might go a long way to reducing the occurrence of this disease.*

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