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# How informative are case studies of spider bites in the medical literature?

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ABSTRACT

We analyzed the reliability and information content of 134 medical case studies on spider bites, published in 91 journal articles. Overall, we found that only 22% of these studies fulfilled the criteria for a verified spider bite. This means that the majority of such case studies cannot be attributed to a given spider species and usually not even to a spider. Their scientific value is negligible, moreover, such publications are even dangerous because they suggest incorrect conclusions. Secondly, we found that such case studies usually do not follow an obvious structure and many details on the development of symptoms, therapy and healing process are widely lacking. So even for verified spider bites, the comparability of case studies is limited. We discuss the obvious failure of a reviewing process for case studies and give recommendations how to increase the currently low information content of medical case studies on spider bites.



## 1. Introduction

Large spiders occasionally bite humans, and in some cases such bites are medically important. However, the scientific and public perception of this is very contrasting: Archeologists are convinced that spider bites are rare and mostly harmless. Recent European (Nentwig et al. 2013) and global reviews (Nentwig and Kuhn-Nentwig, 2013) even concluded that in the last decades no proven fatality had occurred due to a spider bite. Alternatively, there are dozens of publications in the medical literature reporting serious health implications after spider bites, including death (for references see Supplementary Information). This is in line with the current public perception that many spiders are aggressive, dangerous and lethal.

One reason for this obvious discrepancy is the lack of correct diagnoses. Unfortunately, most people, including physicians cannot properly distinguish spiders from ticks, other arachnids or even insects (Vetter et al. 2003), and there are no symptoms that are diagnostic of a spider bite. The only possibility to be sure that an injury had been caused by a spider is to observe the spider while biting, to collect it during or immediately after the bite, and to have it identified by an expert. Although many spider bites are “dry”, i.e., no venom is injected and no negative consequences are observed, the diagnosis of symptoms typically associated with a spider bite is considered as proof of concept of such “verified spider bites” (Isbister and White, 2004; Vetter and Isbister, 2008).

In the medical literature, spider bites are usually published as short case studies, often a short description of a single event (case of one patient). Such reports typically contain some basic data of the patient, the name of the involved spider species, the circumstances of the bite, the symptoms, the medical treatment, and the clinical course of the case. The idea behind such case studies is that by publishing the symptoms, therapies, complications and success, the treatment of spider bites becomes easier and safer.

In the last years, the number of case studies on spider bites increased considerably, obviously indicating some need for this specific kind of publication. Therefore, in this study we asked how informative such case studies are and analyzed 91 case studies on 134 spider bites for the correct verification of spider bites and a sufficient description of symptoms, treatments and success. Since the overall quality of such case reports was very poor, our study also serves as a guide for improving the quality of such case studies in the medical literature.

## 2. Material and method

We searched for case studies on spider bites in the scientific literature. The literature search was done with PubMed, Google

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Scholar and ISI Web of Science, by using the following search terms: Araneae and/or case study, spider bite followed by names of spiders or spider families known to be frequently involved in bites (*Cheiracanthium, Hadronyche, Latrodectus, Loxosceles, Poecilotheria*, Sicariidae, Hexathelidae, Theraphosidae, and Ctenidae). Review papers or papers describing more than one case were only included if detailed descriptions of the single bite cases were given. The analyzed literature covers the years 1939–2014; nine articles appeared until 1979, 22 articles 1980 to 1999 and 60 between 2000 and 2014 (Supplementary information).

The publications were analyzed according to the following parameters: (1) classification of the spider bite following the criteria given by Isbister and White (2004) as either verified or unverified; (2) further data on the bite (when and how), the expert and the spider (family, genus, species, gender, size, deposited where); (3) patient data: age, gender, body part bitten. (4) symptoms: we extracted records for up to 32 different symptoms from the case studies and grouped them into five major categories: pain (local pain, radiating pain), skin symptoms (reddening, swelling), necrosis, circulatory and respiratory problems (including bradycardia, breathing problems, hypertension, hypotension and tachycardia), and general systemic symptoms (including diarrhea, discomfort, dizziness, fever, headache, itching, sweating and vomiting); (5) medical treatment (every medical treatment was registered) and; (6) clinical course (hospitalization, healing) duration (days) and the time for recovery (discharged from hospital or free of symptoms).

## 3. Results

We analyzed 134 case studies of spider bites from 91 publications (listed in Supplementary information). Most cases concerned three *Loxosceles* species (64 case studies), eight *Latrodectus* species (35 case studies), eleven case studies for mygalomorph species (mainly *Hadronyche* and *Poecilotheria*), several *Cheiracanthium* species (five case studies), and 19 other case studies concerning spiders from various families (Table 1).

### 3.1. Verification of spider bite

According to the criteria given by Isbister and White (2004), only 30 of the 134 bite cases analyzed fulfilled all four conditions for verification (22%). Both genera with the highest frequency of reported bites, *Loxosceles* (6 verified bites among 64 reported bites) and *Latrodectus* (3 vs. 35), have in common that less than 10% of reported bites can be regarded as verified. For Hexathelidae and Theraphosidae (eight and 11, respectively) the majority of the bites fulfill the criteria to be considered as verified. For all other spiders (37), roughly half of the bite events can be considered as verified.

The moment of the spider bite was only observed in 60 (45%) of the 134 case studies. In 61 cases, the specimen was mentioned as identified (46%), but in only 30 of these 61 cases do we consider the expertise of the mentioned experts as sufficient (Table 2). In the other 31 cases, the biting specimen was either identified by the staff of the respective emergency departments, the patient himself or other persons with no clear expertise on the subject. Most experts accepted by us as such were located in museums and research institutions, but experts are also animal keepers who know the name of their pets (mainly concerning mygalomorph spiders) (Table 2). In one case the validation of a *Loxosceles* bite with an ELISA test was accepted (Stoecker et al. 2006).

### 3.2. Bite symptoms

We found 32 different symptoms reported in the case studies analyzed, which we grouped into five major symptom groups (Table 3). On average, 5.4 symptoms were mentioned in each case study. However, two case studies mentioned none, six studies only one and 15 studies only two symptoms, while 12 studies mentioned 10 or more symptoms. The most commonly mentioned symptoms were skin reddening (in 72% of all case reports), pain on the bitten body part (49%), and swelling and discomfort (both 34%).

The symptom categories reported per spider taxon are presented in Table 3. Pain is mentioned in 60% of all assumed spider bites and in 87% of all verified bites. Skin symptoms were described for 78% of all cases, but occurred in only 67% of the verified bites. Necrosis was reported in 30% of all assumed spider bites, but could be verified for only 7%. The frequency of reports on circulatory and respiratory problems (36–40%) and on general systemic symptoms (58–67%) did not differ much between all publications and the subset of verified spider bites. This means that spider bites are more painful than assumed, and they cause few skin problems and rarely necrosis.

### 3.3. Medical treatment

Typically, the medical treatment of patients with spider bites is symptomatic. The most commonly administered pharmaceuticals involved analgesics and antibiotics (in 22% of cases each). Tetanus

**Table 1**
Attribution of the analyzed case studies to four taxa groups with included species. The numbers refer to the citation of the respective publication according to the numbering in the supplementary information.

| Hexathelidae and theraphosidae (11 case studies) | Sicariidae: *Loxosceles* (64 case studies) | Theridiidae: *Latrodectus* (35 case studies) | Others (24 case studies) |
|---|---|---|---|
| *Hadronyche cerbera* (53) | *L. arizonica* (9) | *L. geometricus* (28, 42, 57) | *Agelenopsis aperta* (81) |
| *H. formidabilis* (53) | *L. reclusa* (2, 3, 5, 6, 10, 11, 15, 16, 22, 27, | *L. hasselti* (51, 84) | *Amaurobius ferox* (31) |
| *H. infensa (53)* | 30, 32, 33, 36, 37, 39, 40, 49, 54, 55, 56, 60, | *L. hesperus* (17, 46, 47) | *Argiope aurantia* (29) |
| *H.* sp. (53) | 64, 67, 68, 72, 76, 78, 87, 88, 89, 90) | *L. indistinctus* (82) | *Cheiracanthium inclusum* (26, 29) |
| *Lampropelma nigerrimum* (1) | *L. rufescens* (23, 34, 52, 59, 66, 91) | *L. katipo* (18) | *C. mildei* (44) |
| *Poecilotheria fasciata* (20) | *L.* sp. (7, 8, 13, 19, 45, 50, 73, 77) | *L. mactans* (4, 13, 35, 38, 58, 65, 69, 75, 79) | *C.* sp. (21, 24) |
| *P. pederseni* (63) | | *L. revivensis* (70) | *Dysdera crocata* (86) |
| *P. regalis* (1) | | *L. tredecimguttatus* (62, 83) | *Eratigena agrestis* (25, 71) |
| *P. striata* (41) | | *L.* sp. (47, 74) | *Hogna* sp. (48) |
| *Pterinochilus murinus* (1) | | | *Miturga* sp. (86) |
| | | | *Phoneutria nigriventer* (12) |
| | | | *Peucetia viridans* (14) |
| | | | *Steatoda triangulosa* (61) |
| | | | *Steatoda nobilis* (85) |
| | | | *Trachelas tranquillus* (80) |