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Management of severe pain after dermal contact with caterpillars (erucism): a prospective case series

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ABSTRACT

Context: Erucism, envenomation caused by dermal contact with larval forms of moths, may result in intense local pain, mainly after contact with puss caterpillars (family Megalopygidae).

Objective: To evaluate the response to different treatments for controlling severe pain in a case series of erucism in Campinas, southeastern Brazil.

Patients and methods: Prospective cohort study. A Numeric Pain Rating Scale (NPRS 0–10) was used to assess pain intensity in the Emergency Department (ED). Pain was considered as severe upon ED admission (T0) when the NPRS was \geq 8. Inclusion criteria: age \geq 8 years old, severe pain at T0, with continuous assessment of pain intensity in all patients using the NPRS during the ED stay (T5, T15, T30, T60 min and at discharge).

Results: Fifty-five patients fulfilled the inclusion criteria and were divided into three groups according to the initial treatment at T0: local anesthesia alone with 2% lidocaine (group 1, n = 15), local anesthesia and analgesics (group 2, n = 26) and analgesics without local anesthesia (group 3, n = 14). Most patients were admitted within 2 h after dermal contact with the stinging bristles of caterpillars (median =90 min, IQR: 40–125 min). In 22 cases (40%), the caterpillar was brought for identification (*Podalia* spp., n = 18; *Megalopyge* spp., n = 4). There was a significant decrease in pain from T5 onwards with all of the treatments. When the short-term response (T5 and T15) was considered, analgesia was more effective in groups 1 and 2 compared to group 3 (p < .01). Additional analgesia (from T5 until discharge) was frequently required (n = 25/55), mainly in group 1 (n = 11/15). The median length of stay in the ED was 120 min (IQR: 80–173 min).

Conclusions: The association of local anesthesia with analgesics was apparently a good combination for the rapid management of severe pain in the ED.

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KEYWORDS

Analgesia; erucism; Megalopygidae; Numeric Pain Rating Scale; *Podalia* spp; severe pain

Introduction

Erucism is the term used for envenomation caused by dermal contact with the stinging bristles of larval forms of moths (caterpillars; order Lepidoptera) [1–6]. Erucism is frequent in several regions of the world, especially in temperate and tropical climate zones, including Brazil [1–6]. In Brazil, caterpillars of the families Megalopygidae, Saturniidae and Arctiidae are the main causes of erucism [5–9], with ~3700 cases reported yearly to the Brazilian Notifiable Diseases Information System (SINAN, Ministry of Health; 1.8 cases/100,000 inhabitants) [10,11]. Part of these cases are related to envenomation caused by caterpillars of the genus *Lonomia* (lonomism), mainly in southern Brazil [1–7,11]. Lonomism may evolve with severe coagulopathy and life-threatening systemic bleeding and Brazil is the only country that has manufactured and clinically tested a highly effective, specific antivenom for treating this coagulopathy [1–7]. Apart from lonomism, the clinical manifestations of erucism in humans are predominantly local [1–9]. Local pain of variable intensity, the most important complaint of erucism caused by Megalopygidae (puss caterpillars), begins soon after dermal contact with the stinging bristles and may last hours [1–9,12–14]. Severe or excruciating radiating pain, as reported after contact with the North American asp caterpillar *Megalopygidae opercularis* (Texas, southern United States), has been described by some patients as similar to "having hot coal applied to the skin", "being hit on the arm with a baseball bat", "breaking a bone" or "renal colic due to kidney stones" [2,12]. Therefore, an effective therapy that quickly relieves local intense pain should be considered as part of the initial approach for dealing with these patients in the Emergency Department (ED).

In this study, we analyzed the progress of pain and its outcome in relation to different analgesic schemes for

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controlling severe pain in a case series of erucism treated in Campinas, southeastern Brazil.

Patients and methods

A prospective cohort study was undertaken to evaluate a case series of erucism sequentially admitted to the ED at a public university teaching hospital (State University of Campinas) and followed by the Campinas Poison Control Center (PCC), from January 2010 to April 2016. The diagnosis of erucism was based on identification of the offending caterpillar brought by the patients or companions to the ED, or on visual identification of photographs taken of the offending caterpillar at the scene of dermal contact with the stinging bristles. The caterpillars were identified to the level of genus by the main author (a physician) who received a brief training in lepidopteran taxonomy (caterpillars of medical importance in our geographical area) in the Parasitology and Entomology Laboratory of the Butantan Institute, São Paulo, Brazil. When there were doubts about the correct identification, a taxonomic expert (Roberto HP Moraes) in this laboratory was consulted.

A Numeric Pain Rating Scale (NPRS) of 11 points (NPRS 0–10) was used to assess pain intensity at the ED, with NPRS =0 indicating absence of pain and NPRS =10 indicating the worst pain possible. Pain was considered severe upon ED admission (T0) when the NPRS was \geq 8 [15]. The inclusion criteria consisted of an age \geq 8 years old, severe pain at T0, and the continuous assessment of pain intensity using the NPRS during the ED stay (T5, T15, T30, T60 min and at discharge). Only children \geq 8 years old were included in the study since they were considered able to measure the intensity of pain using the NPRS. There was no pre-defined standardized protocol for deciding how to treat each patient and what analgesic/anesthetic combination to use.

A standardized form was used to collect demographic data for each case and included patient sex, age and origin, as well as information on the envenomation (circumstances, clinical manifestations, treatment applied, length of ED stay and outcome). All recorded data were entered into a digital databank designed specifically for this study. Demographic and clinical data were tabulated as actual numbers or as percentages for categorical variables, and as the median and the 25th and 75th percentiles (interquartile range, IQR) for continuous variables; the latter were assumed to have a non-Gaussian distribution. Non-parametric statistical analysis of continuous and dependent variables among groups were done using the Chi-square test (an association test) and the Kruskal-Wallis and Mann-Whitney tests, with p<.05 indicating significance. Significant differences among the treatment groups were initially examined by comparing all groups together across the various time intervals (T0, T5, T15, T30 and T60), followed by systematic pairwise comparisons between groups at each interval using the tests indicated above. All statistical analyses were done using SPSS version 7.5 (SPSS Inc., Chicago, IL). This study was approved by the institutional Committee for Ethics in Research (CEP/FCM/ UNICAMP, no. 1.936.559).

Results

In the study period, 278 cases of erucism were admitted to our ED (*Podalia* spp., n = 108; *Megalopyge* spp., n = 16; Automeris spp., n = 12; Lonomia spp., n = 3; Hylesia spp., n = 1; caterpillars not brought for identification or not photographed, n = 138). Most of the cases occurred during the summer (January to March, 82.6%), in an urban setting (92.1%) and in households (61.3%). Local pain was the main complaint reported (95.3%). The NPRS (0-10) was used to assess pain intensity upon admission to the ED in 224 cases (82.7%) and was classified as severe (NPRS \geq 8) in 124 cases. Of the 124 patients with severe pain, 69 did not meet the inclusion criteria, as there was no assessment of pain intensity at all subsequent intervals, i.e., T5, T15, T30, T60 and discharge. The remaining 55 fulfilled the inclusion criteria for analysis. These 55 cases were further divided into three groups based on the initial treatment at TO: local anesthesia alone with 2% lidocaine and no vasoconstrictors (group 1, n = 15), local anesthesia and analgesics (group 2, n = 26) and analgesics without local anesthesia (group 3, n = 14) (Table 1).

Most of the patients (58.2%) were women with a median age of 48 years. In 22 cases (40%), the offending caterpillar was brought to the ED for identification and was identified as a Podalia spp., probably P. orsilochus considering the geographical region (n = 18, Figure 1(A)) [8], or a Megalopygidae spp. (n = 4). The median time between the dermal contact and admission to the ED was 90 min. There were no significant differences in the values of these variables among the three study groups (Table 1). Most of the contacts with stinging bristles occurred on the fingers/hands (60%), although eight patients had contact with caterpillars at more than one anatomical site (14.5%). In addition to the intense pain, the main local manifestations were radiating pain (90.9%), erythema (87.3%), mild edema (70.9%), paresthesia (30.9%) and regional lymphadenopathy (14.5%). Figure 1(B) shows local dermatitis caused by Podalia spp. in a child. Mild systemic manifestations occurred in 14 cases (25.5%) and consisted predominantly of sweating (16.7%) and dizziness (12.2%).

With regard to the medications used to treat pain upon admission to the ED, local anesthesia was used in 41 patients (74.5%) and analgesics in 42 cases (76.4%), the latter involving mainly dipyrone iv (32.7%) and opioids iv (30.9%; Table 1). In most cases, the decision to treat each patient upon admission with one or another analgesic/anesthetic was taken by the PCC staff on duty at the time, and generally started with local anesthesia to relieve pain as soon as possible (n = 41), followed by iv injection of dipyrone or tramadol (n = 22). In most cases of group 3, the choice of analgesics at T0 was made by the emergency physician on duty at the time. Figure 2 shows the evolution of pain in relation to the time (min) after admission to the ED and the treatments used. There was a substantial improvement in pain within the first 5 min with all treatments used. However, when the response to short-term analgesia (T5 and T15) was assessed, groups 1 (local anesthesia) and 2 (local anesthesia and analgesics) showed more effective analgesia compared to group 3 (analgesics without local anesthesia; p < .01, based on pairwise comparisons between groups); there were no significant

Table 1. Baseline demographic characteristics and analgesic approaches used to manage severe pain in 55 patients admitted to our Emergency Department (ED) after dermal contact with caterpillars.

| | Group 1 (<i>n</i> = 15) | Group 2 (<i>n</i> = 26) | Group 3 (<i>n</i> = 14) | Total (<i>n</i> = 55) | р |
|--|--------------------------|--------------------------|--------------------------|------------------------|-----|
| Age (years): median (IQR; range) | 49 (38–60; 17–71) | 48 (28–59; 12–75) | 41 (31–54; 8–70) | 48 (32–59; 8–75) | .72 |
| Sex (M/F) | 7/8 | 10/16 | 6/8 | 23/32 | .88 |
| Caterpillar brought for identification | 7 | 11 | 4 | 22 | .58 |
| Podalia spp. | 6 | 9 | 3 | 18 | |
| Megalopyge spp. | 1 | 2 | 1 | 4 | |
| Interval between dermal contact with stinging | 79 (20–98; 15–219) | 108 (58–154; 17–300) | 79 (40–116; 10–300) | 90 (40–125; 10–300) | .11 |
| bristles and admission to the ED (min): median (IQR; range) | | | | | |
| Length of ED stay (min): median (IQR; range) | 140 (105–180; 60–365) | 90 (60–148; 60–510) | 120 (94–203; 60–360) | 120 (80–173; 60–510) | .13 |
| Discharge at T60 | 2 | 8 | 2 | 12 | .44 |
| NPRS at discharge ($T > 60$): n ; median (IQI) | 13; 0 (0–1) | 18; 2 (0–3) | 12; 3 (2–4) | 43; 2 (0-4) | .08 |
| Analgesia (T0) | 15 | 26 | 14 | 55 | |
| Local anesthesia (2% lidocaine) | 15 | 26 | 0 | 41 | |
| Opioids | 0 | 9 | 8 | 17 | |
| Tramadol iv | 0 | 9 | 5 | 14 | |
| Tramadol iv plus dipyrone iv | 0 | 0 | 1 | 1 | |
| Morphine iv | 0 | 0 | 1 | 1 | |
| Meperidine iv | 0 | 0 | 1 | 1 | |
| Non-opioid analgesics | 0 | 17 | 6 | 23 | |
| Dipyrone iv | 0 | 13 | 4 | 17 | |
| Dipyrone po | 0 | 2 | 1 | 3 | |
| Paracetamol po | 0 | 2 | 0 | 2 | |
| Tenoxicam iv plus dipyrone po | 0 | 0 | 1 | 1 | |
| Additional analgesia (T5 to discharge) | 11 | 8 | 6 | 25 | .03 |
| Local anesthesia (2% lidocaine) | 8 | 6 | 5 | 19 | |
| Opioids | 5 | 9 | 3 | 17 | |
| Tramadol iv | 4 | 3 | 1 | 8 | |
| Morphine iv or sc | 0 | 3 | 0 | 3 | |
| Codeine + Paracetamol po | 1 | 3 | 2 | 6 | |
| Non-opioid analgesics | 9 | 1 | 0 | 10 | |
| Dipyrone iv | 7 | 1 | 0 | 8 | |
| Dipyrone po | 1 | 0 | 0 | 1 | |
| Paracetamol po | 1 | 0 | 0 | 1 | |

NPRS: Numeric Pain Rating Scale (NPRS 0-10); T: time (min) after admission to the ED.

^aSignificant difference between groups 1 and 2, calculated by comparing the proportions among the three groups (Chi-square test).



Figure 1. (A) Caterpillar of the genus *Podalia* (Megalopygidae). Photograph by Yuri Bucaretchi (February 2016), in Campinas, southeastern Brazil (22°48′18.5″S 47°04′07.2″W). White arrow indicates cephalic region. (B) Local lesion caused by dermal contact with stinging bristles of Podalia spp. in a 9-year-old girl. Photograph taken 17 h post-contact.

differences between groups 1 and 2. Additional analgesia (from T5 until discharge) was frequently required (45.5%), mainly in group 1 (n = 11/15); local anesthesia (n = 19), opioids (n = 17) and dipyrone iv (n = 8) were the most commonly used treatments. The median length of the ED stay was 120 min (Table 1).

Discussion

Caterpillars of the genera *Megalopyge* and *Podalia* (Megalopygidae), commonly referred in Brazil as "taturana-

gatinho" (puss caterpillar) or "taturana-cachorrinho" (puppy caterpillar), have two types of bristles: short stinging bristles (arrows or spines) that are sharp and small and are connected to venom glands at their base, and non-noxious bristles that are longer, feathery, colorful and superficial [6,8,9]. The morphological features of stinging bristles have been described in detail for *Megalopyge crispata* that infests oak forests in western Oklahoma (USA), based on scanning electron microscopy (SEM) [16]. Similar findings using SEM have also recently been reported for *Podalia fuscescens* from the Misiones region of northeastern Argentina [17].



Figure 2. Box plots showing the evolution of pain according to the treatments employed. Group 1, exclusive local anesthesia with 2% lidocaine at T0; group 2, local anesthesia plus analgesics at T0; Group 3, analgesics without local anesthesia at T0. Pairwise comparisons identified significant differences (p < .01) between group 1 and group 3, and between group 2 and group 3 at T5 and T15 in both cases. There were no significant differences between groups 1 and 2 at T5 and T15. NPRS, Numeric Pain Rating Scale (NPRS 0–10); *T*, time (min) after admission to the ED. Additional analgesia (T5 until discharge) was frequent (n = 25/55); see Table 1 for more details.

The soft harmless longer "outer" bristles of puss caterpillars are not sufficiently robust to prevent accidental contact with the underlying stinging bristles when the victim inadvertently touches these animals and this leads to the release of toxins into the host's subcutaneous tissue. The toxins identified in larval forms of moths include thermolabile proteins, proteolytic enzymes, plasminogen activators with trypsin and chymotrypsin activities and histamine [9]. The analysis of a bristle extract from Megalopyge spp. indicated that this extract was mainly proteinaceous and did not contain histamine, serotonin, kinins or acetylcholine [18]. More recent work has shown that the bristle extracts of Podalia fuscescens have strong proteolytic activity, mild phospholipase A_2 and hyaluronidase activities, and a weak in vitro procoagulant activity [17]. However, the pathophysiology of the ensuing local pain in erucism remains unclear [1-6,9]. In particular, it is unclear whether the immediate pain from contact with stinging bristles is associated with a pro-inflammatory action, or whether the toxins present in the venom exert a direct stimulatory effect on peripheral sensory neurons.

The high frequency of local pain seen in our study (95.3% of 278 cases) is similar to that described in erucism by *M. opercularis*, the most common cause of erucism in southern United States (mainly Texas), with pain in 84–99% of the cases [12,13,19]. Although the local manifestations associated with erucism by *M. opercularis* are similar to those described here, the local lesion caused by *M. opercularis* is distinct (grid-like petechial eruption); this pattern is created by parallel rows of short, stiff hollow spines on the dorsum of the caterpillar and is usually seen 2–3 h after contact [4,12,13].

Several procedures have been described for treating local pain in erucism, such as the use of local anesthesia (topical use or infiltration), opioid and non-opioid analgesics, antiinflammatory medications, ice-packs and cold compresses [4,7,9,14,19,20]. However, none of these studies used a validated pain scale to objectively measure the intensity of pain, nor did they assess the efficacy of analgesia in formal clinical trials.

In the present study, the pain intensity was assessed using an 11-point NPRS (0–10) that has already been validated, is simple to apply and is comprehensible to most

people [15,21]. Although some authors have postulated that severe pain would be located between 7 and 10 in the NPRS [21], we chose to consider the 8–10 interval as severe pain [15]. The most frequently used option, namely the infiltration of 2% lidocaine to control severe pain in patients admitted to the ED, followed the recommendation of the Brazilian Ministry of Health guidelines and other Brazilian authors [5,7,9]. Pain relief was apparently faster in the groups treated with local anesthesia (groups 1 and 2), at least within the first 15 min. However, patients who were treated with only local anesthesia at admission required additional analgesia at a higher frequency than in the other groups, mainly from T30 onwards. This finding suggested that the association of local anesthesia and analgesics upon admission to the ED could lead to better pain management.

The present study has several limitations, including an important loss of cases with severe local pain (n = 69/124) since they did not fulfill the required inclusion criteria. Furthermore, this is not a clinical trial since the study groups were not randomized and the treatments did not follow a pre-defined standardized protocol. Although the classification of pain using the NPRS has been validated and is well-established, pain is a subjective symptom that shows considerable individual variation in intensity and tolerance, and is subject to psychosocial influences. Finally, although patients with severe pain caused by erucism were advised to maintain analgesia with a paracetamol/codeine combination or dipyrone p.o. for at least 24-48 h, there was no routine follow-up of all patients after discharge from the ED; this lack of follow-up precluded a more accurate assessment of the progression or recurrence of pain. Despite the limitations indicated above, this is the first study to examine the severity of pain in a case series of erucism using a validated pain scale and to provide a detailed description of how the pain was managed.

In conclusion, our results show that severe pain is a frequent complaint associated with erucism in Campinas, southeastern Brazil, and is mainly related to puss caterpillars of the genus *Podalia*. The association of local anesthesia with analgesics was apparently a good combination for the rapid management of severe pain in the ED.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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