Cutaneous hemorrhage or necrosis findings after Vespa mandarinia (wasp) stings may predict the occurrence of multiple organ injury: A case report and review of literature

Article *in* Clinical Toxicology · October 2007

DOI: 10.1080/15563650701664871 · Source: PubMed

4 authors, including:

Youichi Yanagawa
Shizuoka Hospital Juntendo University
295 PUBLICATIONS **1,508** CITATIONS

Clinical Toxicology (2007) **45**, 803–807

ISSN: 1556-3650 print / 1556-9519 online
DOI: 10.1080/15563650701664871

informa
healthcare

CASE REPORT

Cutaneous hemorrhage or necrosis findings after *Vespa mandarinia* (wasp) stings may predict the occurrence of multiple organ injury: A case report and review of literature

YOUICHI YANAGAWA, M.D., PH.D., KENTARO MORITA, M.D., TAKAO SUGIURA, M.D., and YOSHIAKI OKADA, M.D., PH.D.

Department of Traumatology and Critical Care Medicine, National Defense Medical College, Saitama, Japan

Data Sources. We report one case and analyzed 15 Japanese cases concerning multiple organ failure induced by wasp stings. *Data Extraction*. Thirteen of 15 cases were associated with skin hemorrhage or necrosis after wasp stings. The mean number of stings (± standard error) in the patients who died (59 ± 12) was significantly greater than that in those who survived (28 ± 4, p=0.01). *Conclusion*. The occurrence of skin hemorrhage or necrosis after wasp stings is extremely rare and multiple organ injury after wasp stings is also a rare complication. Thus, cutaneous hemorrhaging or necrosis findings after wasp stings may suggest the development of multiple organ injury. In addition, the number of stings may play an important role in predicting outcome.

Keywords Wasp; Sting; Organ; Injury; Skin; Necrosis

Introduction

In Japan, fatalities due to *Vespa mandarinia* (wasp) stings are estimated to range from 30 to 50 persons each year. Most victims appear to die from anaphylaxis or sudden cardiac arrest (1–3), while some of them die from to multiple organ failure including rhabdomyolysis, renal failure, liver dysfunction, respiratory failure, and disseminated intravascular coagulopathy (1). Large number of stings by wasps may induce multiple organ failure (4). We analyzed Japanese reports concerning multiple organ failure induced by wasp stings and we found that most such cases were associated with skin hemorrhage or necrosis after wasp stings. The occurrence of skin hemorrhage or necrosis after wasp stings is rare (5). In addition, multiple organ injury after wasp stings is a rare complication. We report our hypothesis that cutaneous hemorrhaging or necrosis findings after wasp sings may suggest the development of multiple organ injury.

Received 2 February 2006; accepted 9 June 2006.
There was no financial support on this project.
Address correspondence to Youichi Yanagawa, Department of Traumatology and Critical Care Medicine, National Defense Medical College, 3-2 Tokorozawa Saitama, Japan 359-8513. E-mail: yanagawa@me.ndmc.ac.jp

Case report

A 57-year-old man suffered multiple wasp stings (*Vespa mandarinia* Japonica) while working in his backyard. He complained of dyspnea and was transferred to our hospital. He had no contributory past medical or family history. On arrival, his vital signs were blood pressure 88/54 mmHg, pulse rate 124 beats per minutes, respiratory rate 30 beats per minutes, and temperature 36.6° Celsius. He had 38 wasp-sting marks with cutaneous hemorrhages measuring from 5 to 12 mm in size, and redness and swelling over his whole body surface (Fig. 1). The results of laboratory analyses of the blood were pH 7.168, pCO_2 33.3 mmHg, pO_2 181.5 mmHg, HCO_3^- 11.6 mmol/L, and base excess –16.5 mmol/L (under oxygen 8 L/minute). WBC 11700/ microl, hemoglobin 17.7 g/dl, platelets 19.0×10^4/ microl, total bilirubin 0.6 mg/dl, aspartate aminotransferase (AST) 39 IU/L, alanine aminotransferase (ALT) 14 IU/L, CK 178 IU/L, amylase 84 IU/L, urea 21 mg/dl, creatinine 1.07 mg/dl, Na 142 mEq/L, K 3.1 mEq/L, Cl 104 mEq/L, c-reactive protein 0.3 mg/dl, and glucose 188 mg/dl. His chest x-ray and electrocardiogram findings were normal. He received intrathecal epinephrine, intravenous epinephrine, corticosteroids and glycyrrhizin with rapid infusion of 1 L lactated Ringer solution. Glycyrrhizin, an active component of licorice roots, is used in Japan to treat hepatitis or skin lesions, including anaphylaxis; it has anti-inflammatory, immunomodulatory and antiviral properties. His wasp stings were treated with a combination of corticosteroid and gentamycin ointment. After these treatments,

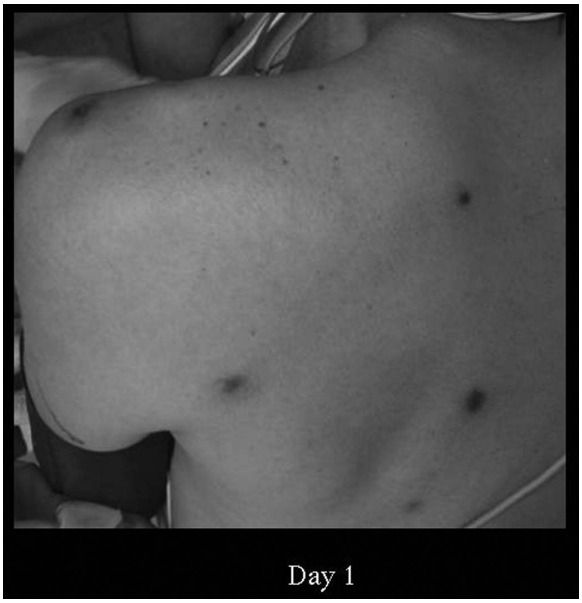

Fig. 1. Skin lesions after 30 minutes from a wasp sting. The patient demonstrated a cutaneous hemorrhage as a wasp sting mark.

both his symptoms and vital signs improved. On the second hospital day, he demonstrated hypertension (BP 170/100 mmHg), deterioration of the swellings and cutaneous hemorrhaging changing into necrosis (Fig. 2). His laboratory findings were creatine kinase (CK) 1600 IU/L, AST 979 IU/L, ALT 257 IU/L, and platelets 14.8×10^4/ microl. On the third hospital day, the swelling had improved but the laboratory findings further deteriorated (CK 39180 IU/L, AST 1054 IU/L, ALT 284 IU/L and platelets 8.9×10^4/ microl). A biopsy of a skin lesion on his back was performed (Fig. 3). The pathological results demonstrated epidermal and dermal necrosis. From the fourth hospital day, all laboratory findings and blood pressure improved. Because the laboratory findings were improved (CK 208 IU/L, AST 32 IU/L, ALT 116 IU/L and platelets 18.3×10^4/ microl) and the skin lesions did not develop any infection, he was discharged on day 10. On the day 19 from the wasp stings, the laboratory findings returned to within the normal limit. The skin lesions changed into areas of dry necrosis (Fig. 4).

Fig. 2. Skin lesions on second hospital day. The cutaneous hemorrhage changes into a necrotic lesion.

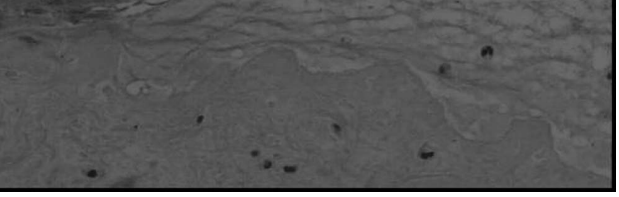

Fig. 3. Histopathological findings after wasp stings on second hospital day (Haematoxylin and eosin stain x 200). Histopathological examination revealed dermoepidermal coagulative necrosis with vesiculation and dermal neutrophilic infiltration.

Fig. 4. Skin lesions on day 19 from wasp stings. The necrotic lesion changes into dry necrosis.

Analysis of Japanese reports

An Ichushi search (Japana Centra Revuo Medicine), which collects summaries of Japanese medical articles, was undertaken to identify articles from 1983 to 2006 using the key words "wasp stings" and "insect stings." Additional articles were identified by a manual search of the references from the key articles. We found 47 articles about wasp stings. Of these, there were 17 epidemiology studies, five articles about ophthalmic injury, four articles about biochemical analyses of IgE or histamine, and four articles concerning treatment; these 30 articles were excluded from the analysis due to lack of patient data or cutaneous findings. Three articles described unusual complications after wasp stings: nephrosis, Bell's palsy, and Guillain-Barre syndrome. All three cases reported no other organ injury, or cutaneous hemorrhage or necrosis. The remaining 14 cases described individuals with organ injury after wasp (*Vespa mandarinia*) stings. We summarized these cases, including the present case, in Table 1 (6–19). All cases had rhabdomyolysis and liver dysfunction. Three of fifteen cases did not develop anaphylactic shock and ten of fifteen cases suffered fewer than 50 sings. Thirteen of fifteen cases developed skin hemorrhage or necrosis. Six of the fifteen died due to multiple organ failure. The average number of stings (± standard error) in the patients who died (59 ± 12) was significantly greater than that in those who survived (28 ± 4, p=0.01) when analyzed using the chi-square test.

Discussion

The venom of *Vespa mandarinia* is composed of amines, peptides and enzymes. The amines are histamine, serotine and acetylcholine; the peptide are mastoparan and hornet kinin; and the enzymes are phospholipase A, hyalulonidase, and protease (20–22). Mastoparan, phospholipase A, and hyalulonidase can each damage cell membranes directly (21,23,24) and, as a result, rhabdomyolysis could result (24,25). In addition, acute renal failure or hepatic injury may occur due to the direct nephrotoxicity or hepatotoxicity of the venom (26).

Reactions by humans to the venom of wasps are mainly divided into two types. One is IgE-mediated anaphylaxis and the other is the direct toxic effect of venom (4). The allergic reaction can be induced by only one sting while direct toxicity depends on the amount of venom. Accordingly, a larger number of stings by wasps can induce more severe intoxication in the human body (23). The Good Samatarian Regional Poison Center recommends that pediatric, older patients, and patients with underlying medical problems should be admitted for 24 hours after an envenomation of 50 or more stings (23). In our research, the average number of stings in the patients who died was significantly greater than that those observed in the surviving patients. As a result, the number of stings may therefore play an important role in predicting the outcome. However, ten of fifteen cases suffered fewer than 50 stings yet they still demonstrated multiple organ injury. Case number 11 in the table suffered only three stings and did not show even anaphylactic shock but did demonstrate liver dysfunction, rhabdomyolysis and acute renal failure which required temporary hemodialysis. As a result, the number of stings is not always a reliable predictor of multiple organ injuries.

Typical skin lesions after wasp stings are redness and swelling, which subside within a few days (27, 28). The occurrence of skin hemorrhage or necrosis after wasp stings

Table 1. Wasp stings in Japan

No., Reporter	Age, Gender	Duration from stings to arrival	Cutaneous hemorrhage or necrosis	Number of stings	Complication	Outcome
Present case	57, M	30 minutes	+	38	LD, T, R, S	Survival
1. Iwamura	80, M	62 minutes	+	78	RF, LD, ResF, DIC, RF, S	Death
2. Shioshita	80, M	< 24 hours	–	30	RF, LD, P, F, S	Survival
3. Konishi	61, M	60 minutes	+	17	LD, R, S	Survival
4. Ishii	55, F	30 minutes	+	100	RF, LD, ResF, DIC, R, S	Death
5. Fujibayashi	74, M	24 hours	+	50	RF, HepF, RF, HF, DIC, R	Death
6. Touno et	76, M	unknown	–	20	RF, LD, R, S	Survival
7. Mourie	39, F	< 8hours	+	> 50	RF, LD, ResF, DIC, R, S	Survival
8. Yamaguchi	57, M	48 hours	+	27	RF, HepF, HF, R, S	Survival
9. Nishimura	86, F	1 hour	+	30	LD, R, S	Survival
10. Kanehisa	78, M	2 hours	+	30–40	RF, LD, ResF, T, R	Death
11. Fujiwara	79, M	7 days	+	3	RF, LD, R	Survival
12. Yoshida	71, M	5 hours	+	70	RF, HepF, ResF, HF, DIC, R, S	Death
13. Ohashi	62, M	<24 hours	+	17	RF, LD, ResF, DIC, R, S	Death
14. Tsujimura	36, M	4 days	+	30–40	RF, LD, R, S	Survival

F: female; M: male; DIC: disseminated intravascular coagulopathy; LD: liver dysfunction; HF: heart failure; HepF: hepatic failure; R: rhabdomyolysis; RF: renal failure; ResF: respiratory failure; P: pancreatitis; S: shock; T: thrombocytopenia.

Table 2. Wasp stings with multiple organ failure in other countries

Reporter	Nation	Age, Gender	Duration from sting to arrival	Expression of cutaneous findings	Number of stings	Outcome
Vikrant	India	62, F	4 days	sting mark	40	Survival
		7, M	5 days	sting mark	25	Death
		38, F	2 days	sting mark	30	Survival
Bhatta	Nepal	10, F	13 days	sting mark	over 200	Survival
		13, F	3 days	sting mark	over 150	Survival
Chao	Taiwan	46, M	9 days	scar	40–50	Survival
Kim	Korea	63, M	3 days	sting lesion	50–60	Survival
Subramanian	India	12, M	3 days	sting mark	250	Survival
Vachvanichsanong	Thailand	4, F	6 days	sting lesion	20–30	Survival
		4, M	10 days	raised carcinate margin and central necrosis	66	Survival
Watemberg	Israel	3, M	unknown	violaceous skin patches	over 40	Death
Barss	PNG	22, M	3 days	punced out	many	Death
Laosombat	Thailand	9, F	6 days	distinct sting mark	40	Death
Chugh	India	38, M	1 day	distinct sting mark (4th day)	55	Survival
Sitprija	Thailand	71, F	3 days	no edema or swelling	unknown	Survival

F: female; M: male; PNG: Papua New Guinea.

is rare (5). Ando reported 1,711 cases of hymenoptera (70% wasp attacks) stings but did not describe any hemorrhagic or necrotic cutaneous changes; 3% demonstrated anaphylactic shock, but none had multiple organ failure (29). Ogawara reported 1,541 cases of hymenoptera stings with neither hemorrhagic nor necrotic cutaneous changes; 1% had anaphylactic shock but none had multiple organ failure (30). However, all the reports we could find concerning skin necrosis after wasp stings in Japan since 1983 were also associated with multiple organ injury. Hence, the occurrence of cutaneous hemorrhagic or necrotic change after wasp stings may suggest that the toxicity of the venom is stronger than usual (average wasp) or the individual ability to neutralize or inactivate the venom is weak. A strong toxicity or weak neutralization of venom may induce multiple organ injury.

The hemorrhagic or necrotic cutaneous changes that occur after wasp stings may only be induced by Japanese wasp stings, because the strength of venom differs from species to species (31). We, therefore, performed a Medline search to identify any related articles from 1983 to 2006 using the key words "wasp stings" and "multiple organ failure" or "renal failure." We could not find any case reports with photographic figures depicting cutaneous findings. We summarized the case reports which described the cutaneous findings after wasp stings, excluding case reports which described cutaneous findings only on the first day because the sting mark was easy to find on first day (Table 2) (32–42). Most cases described the injured area as sting marks or sting lesions even after two days or more from wasp stings when sting marks are usually hard to recoginize (28). Some of them described the injured area as violaceous skin patches or punched out lesions or distinct sting marks. These expressions may apply to our case. Chao et al. described lesions as "scars" nine days from sting, similar to our case (34). As a result, cutaneous hemorrhaging or necrosis findings after wasp stings may be associated with multiple organ injury even in other countries. In addition, concerning bee stings, Tumwine (Zimbabwe), Bresolin (Brazil), and Franca (United Kingdom) in other countries have also reported cases of bee stings with findings of both cutaneous hemorrhages or necrotic lesions and multiple organ injury (43,44).

An analysis of Japanese wasp stings cases revealed that fewer than 50 wasp stings could induce multiple organ injury and most such cases were associated with cutaneous hemorrhaging or necrosis. Both multiple organ injury and cutaneous hemorrhage or necrosis were rare complications after wasp stings. As a result, cutaneous hemorrhaging or necrosis findings after wasp stings may be useful for predicting the occurrence of multiple organ injury.

References

1. Vetter RS, Visscher PK, Camazine S. Mass envenomations by honey bees and wasps. West J Med 1999; 170:223-7.
2. Johansson B, Eriksson A, Ornehult L. Human fatalities caused by wasp and bee stings in Sweden. Int J Legal Med 1991; 104:99–103.
3. Mosbech H. Death caused by wasp and bee stings in Denmark 1960–1980. Allergy 1983; 38:195–200.
4. Vetter RS, Visscher PK, Camazine S. Mass envenomations by honey wasps and wasps. West J Med 1999; 170:223–7.
5. Kocer U, Ozer Tiftikcioglu Y, Mete Aksoy H, Karaaslan O. Skin and soft tissue necrosis following hymenoptera sting. J Cutan Med Surg 2003 ;7:133–5.
6. Iwamura T, Kitahara M, Nakashima A, Oogushi K, Hirahara K, Taki K, Yamamoto F: A case of fatal multiple organ failure following massive hornet stings. JJAAM (in Japanese) 2006; 17:67–73.
7. Shioshita K, Izumikawa K, Hara K, Nazneen A, Furusu A, Miyazaki M, Kohno S. Multiple organ failure due to Vespa mandarinia stings. J Jpn Soc Dial Ther (in Japanese) 2003; 36:131–4.

8. Konishi N, Suzuki K. A case of rhabomylysis caused by wasp sting. Rinsho Derma (Tokyo, in Japanese) 2002; 44:1125–8.
9. Ishii T, Hisadome T, Yamamoto A, Hirano S, Okabe H, Shokyu Y, Tsurusaki N. A case of multiple organ failure following hornet stings. Jpn J Acute Med (in Japanese) 2001; 25:987–90.
10. Fujibayashi T, Yasuda Y, Ishimoto M, Suzuki H, Fukuda S, Naiki H. An autopsied case of multiple organ failure due to vespa mandarinia stings. J Jpn Soc Intensive Care Med (in Japanese) 2001; 8:171–6.
11. Touno C, Kawamura H. A case of rhabomylysis and acute renal failure after wasps sings. Iwate prefecture Med J (in Japanese) 2001; 41:31–34.
12. Mouri M, Hino H, Yokota E, Matsumoto I, Ashihara T, Mitsui K, Harada A. A case of recovery from multiple organ failure induced by bee stings after treatments of continuous hemodiafiltration and plasma exchange. Jpn J Clin Exp Med (in Japanese) 1999; 76:1355–8.
13. Yamaguchi Y, Kinoshita Y. A case of acute renal failure due to bee-sting-induced rhabdomyolysis. J Jpn Red Cross Sendai Hosp (in Japanese) 1999; 8:81–6.
14. Nishimura Y, Nagai S, Tadokoro M, Tsuda K. A case of rhabomylysis caused by bee sting. J Tottori Med Assoc (in Japanese) 1997; 25:52–6.
15. Kanehisa Y, Makihata K, Fujiwara K, Ono T. Acute renal failure following the bite of the hornet. J Tottori Med Assoc (in Japanese) 1993; 46:402–404.
16. Fujiwara R, Amejima S, Tamai T, Nakai T, Miyabo S. A case of acute renal failure after bee sting. Diagnosis and Treatment (in Japanese) 1992; 80:1978–80.
17. Yoshida A, Orihashi K, Nishida T, Maehara Y, Fujii K. Multiple organ failure due to Vespa mandarinia stings. Jpn J Acute Med (in Japanese) 1989; 13:1161–4.
18. Ohashi H, Ishigro M, Yasue T, Watanabe S, Sugishita N, Ohtani M, Sasaoka I, Kuniyasu T. An autopsy case of acute renal and respiratory failure following wasp stings. J Jpn Soc Int Med (in Japanese) 1987; 76:398–403.
19. Tujimura H, Tanaka T, Oryu T, Yamamoto H, Nakajima M. A case study of acute renal failure after being stung by wasps. Kidney and Dial (in Japanese) 1984; 16:85–8.
20. Hirai Y, Kuwada M, Yasuhara T, Yoshida H, Nakajima T. A new mast cell degranulating peptide homologous to mastoparan in the venom of Japanese hornet (Vespa xanthoptera). Chem Pharm Bull (Tokyo) 1979; 27:1945–6.
21. Katsu T, Sanchika K, Yamanaka H, Shinoda S, Fujita Y. Mechanism of cellular membrane damage induced by melittin and mastoparan. Jpn J Med Sci Biol 1990; 43:259–60.
22. Abe T, Kawai N, Niwa A. Purification and properties of a presynaptically acting neurotoxin, mandaratoxin, from hornet (Vespa mandarinia). Biochemistry 1982; 21:1693–7.
23. Kolecki P. Delayed toxic reaction following massive bee envenomation. Ann Emerg Med 1999; 33:114–6.
24. Ownby CL, Powell JR, Jiang MS, Fletcher JE. Melittin and phospholipase A2 from bee (Apis mellifera) venom cause necrosis of murine skeletal muscle in vivo. Toxicon 1997; 35:67–80.
25. Azevedo-Marques MM, Ferreira DB, Costa RS. Rhabdomyonecrosis experimentally induced in Wistar rats by Africanized bee venom. Toxicon 1992; 30:344–8.
26. Neuman MG, Ishay JS, Eshchar J. Hornet (Vespa orientalis) venom sac extract causes hepatic injury in cats. Comp Biochem Physiol C 1983; 74:469–72.
27. Horiuchi N. The sting of a bee and the sting of an ant (in Japanese). Comprehensive Handbook of Clinical Dermatology, Nakayama-shoten Co. Ltd., Tokyo, vol. 19, 2003:33–38
28. Wilson DC, Smith ML, King Jr LE. Arthropod bites and stings (Fitzpatrick's Dermatology in General Medicine 6th ed., vol. 2. McGraw-Hill, New York, 2003:2289–98.
29. Ando Y. Patients with Hymenoptera sings treated at Saku Central Hospital. Review of 13 year's statistics. Jon Assoc Rural Med (in Japanese) 1993; 42:950–5.
30. Ogawara T. Familiar danger-Hymenoptera stings (in Japanese). Nagano: Creative Center Press, 2002:1–187.
31. Schmidt JO, Yamane S, Matsuura M, Starr CK. Hornet venoms: lethalities and lethal capacities. Toxicon 1986; 24:950–4.
32. Vikrant S, Pandey D, Machhan P, Gupta D, Kaushal SS, Grover N. Wasp envenomation-induced acute renal failure: A report of three cases. Nephrology (Carlton) 2005; 10:548–52.
33. Bhatta N, Singh R, Sharma S, Sinnha A, Raja S. Acute renal failure following multiple wasp stings. Pediatr Nephrol 2005; 20:1809–10.
34. Chao YW, Yang AH, Ng YY, Yang WC. Acute interstitial nephritis and pigmented tubulopathy in a patient after wasp stings. Am J Kidney Dis 2004; 43:e15–9.
35. Kim YO, Yoon SA, Kim KJ, Lee BO, Kim BS, Chang YS, Bang BK. Severe rhabdomyolysis and acute renal failure due to multiple wasp stings. Nephrol Dial Transplant 2003; 18:1235.
36. Subramanian C, Jain V, Singh M, Kumar L. Allergic and systemic reactions following yellow jacket stings. Indian Pediatr 2000; 37:1003–5.
37. Vachvanichsanong P, Dissaneewate P, Mitarnun W. Non-fatal acute renal failure due to wasp stings in children. Pediatr Nephrol 1997; 11:734–6.
38. Watemberg N, Weizman Z, Shahak E, Aviram M, Maor E. Fatal multiple organ failure following massive hornet stings. J Toxicol Clin Toxicol 1995; 33:471–4.
39. Barss P. Renal failure and death after multiple stings in Papua New Guinea. Ecology, prevention and management of attacks by vespid wasps. Med J Aust 1989; 151:659–63.
40. Laosombat V, Chub-uppakarn S. Acute renal failure following wasp stings. J Med Assoc Thai 1982; 65:511–3.
41. Chugh KS, Sharma BK, Singhal PC. Acute renal failure following hornet stings. J Trop Med Hyg 1976; 79:42–4.
42. Sitprija V, Boonpucknavig V. Renal failure and myonecrosis following wasp-stings. Lancet 1972; 7753:749–50.
43. Tumwine JK, Nkrumah FK. Acute renal failure and dermal necrosis due to bee stings: Report of a case in a child. Cent Afr J Med 1990; 36 202–4.
44. Bresolin NL, Carvalho LC, Goes EC, Fernandes R, Barotto AM. Acute renal failure following massive attack by Africanized bee stings. Pediatr Nephrol 2002; 17:625–7.