

A study of wasp bites in a tertiary hospital of western Nepal

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ABSTRACT

Hymenopterid stings and subsequent allergic reactions including fatal anaphylaxis are common indications for emergency department visits worldwide. Besides that, sting can cause death as a result of multi-system involvement ranging from intravascular hemolysis, rhabdomyolysis, acute renal failure, hepatic dysfunction and occasionally thrombocytopenia and coagulopathy. Eleven cases (all male, age 35.5 ± 15.2 years) of wasp bites admitted in the Manipal Teaching Hospital (MTH), Pokhara during 01st February, 2006 to 30th October, 2007 were enrolled in this study. Mean wasp bites number was 48.7 ± 7.1 (11—100) and mean time to reach the hospital from the bite time was 69.1 ± 149.7 hours (1.5h-12 days). Nine patients developed acute renal failure (ARF) and secondary hypertension. Eight patients underwent hemodialysis. Two patients stuck by more than 75 stings developed refractory pulmonary edema and died in the course of treatment. Victims with lesser numbers of wasp envenomation, who received quick initiation of alkaline diuresis and intensive dialytic support had shorter hospital stay and less severe complications.

Keywords: Acute renal failure; Hemodialysis; hymenoptera; rhabdomyolysis; wasp envenomation.

INTRODUCTION

The medically important groups of Hymenoptera are the Apoidea (bees), Vespoidea (wasps, hornets, and yellow jackets), and Formicidae (ants); who deliver their venom by stinging their victims. Hymenopterid stings and subsequent allergic reactions are a common indication for emergency department visits worldwide. Unrecognized anaphylactic reactions to hymenopterid stings is a significant cause of sudden and unanticipated deaths among young people, with and without atopic histories.¹

Death from honey bee or wasp envenomation is a rare event. Most often it is caused by immunoglobulin E-mediated Type I anaphylaxis, and the fatal incident involves a single sting. Onset of life-threatening, anaphylactic signs typically occur within 10 minutes of the sting.² Anaphylactic reactions to hymenoptera stings are not dose dependent or related to the number of stings.²

Less commonly, death in nonallergic individuals occurs as a result of multi-system involvement ranging from intravascular hemolysis, rhabdomyolysis, acute renal failure, hepatic dysfunction and occasionally thrombocytopenia and coagulopathy. Renal failure is usually due to development of acute tubular necrosis as a result of intravascular haemolysis, rhabdomyolysis or shock. Rarely, it may follow development of acute tubulo-interstitial nephritis. This article reviewed serious systemic complications and the outcomes of wasp bites.

MATERIAL AND METHODS

Eleven cases of wasp bites admitted in the Manipal Teaching Hospital (MTH), Pokhara during 01st February, 2006 to 30th October, 2007 were enrolled in this study. The diagnosis of wasp bites was based on clinical history and physical findings. Standard wasp bite management protocol was followed for the emergency management of patients once patient was brought to the hospital, and subsequently patients were admitted in intensive care unit (ICU) for the further management. Detail history was recorded and clinical examinations and investigations were performed to get the complete clinical characteristics of the individual patients which included age, sex, number of wasp bites, duration from bite to reach the hospital, rhabdomyolysis, hemolysis, liver injury, acute renal failure, myocarditis, coagulopathy, pulmonary edema, secondary hypertension, and other complications.

RESULTS

All the eleven cases of wasp bites were admitted in the Manipal Teaching Hospital (age 35.5 ± 15.2 years) were male. Mean wasp bites number was 48.7 ± 7.1 (11—100) and mean time to reach the hospital from the bite time was 69.1 ± 149.7 hours (1.5h-12 days). Nine patients developed acute renal failure (ARF) and secondary hypertension while 8 patients had features of rhabdomyolysis and hemolysis. Eight patients underwent hemodialysis among which a case was referred to

Table-1: Clinical characteristics of wasp bite patients

| | |
|--|----------------------------|
| Age | 14-62 (35.5±15.2) |
| Sex (M:F) | 11:0 |
| Days of hospital admission (X ⁻ ± S.D.) | 1- 20 (9.1±7.9) |
| No of wasp bites | 11-100 (48.7 ± 7.1) |
| Duration from bite to reach hospital | 1.5h-12 days (69.1 ±149.7) |
| ARF | 9 (82.0%) |
| Secondary HTN | 9 (82.0%) |
| Rhabdomyolysis | 8 (73.0%) |
| hemolysis | 8 (73.0%) |
| Anuria/oligouria | 7 (64.0%) |
| Liver injury | 7 (64.0%) |
| Dialysis done | 8 (73.0%) |
| Coagulopathy | 5 (45.0%) |
| Myocarditis | 2 (18.0%) |
| Pulmonary edema | 2 (18.0%) |
| died | 2 (18.0%) |
| septicemia | 1 (9.0%) |

Kathmandu for the hemodialysis since he was HIV positive. Two patients had developed refractory pulmonary edema, had more than 75 enumeration of wasp and died during the course of treatment. The clinical characteristics are depicted in Table-1.

Victim who had less than 25 wasp bites developed rhabdomyolysis and hemolysis. There was no evidence of liver injury or ARF in him. Similarly two victims had more than 75 bites, one of them died while another had 17 days of hospital admission and survived. One case had more than 100 wasp envenomation; though he arrived in hospital within the 12 hours of envenomation, still died because of refractory pulmonary edema (Table-2). Table 2 has clearly demonstrated that patients having less numbers of wasp envenomation had shorter duration of hospital stay and less severe complications.

Duration from bite to reach the hospital also directly co-relates with the patients prognosis. Four patients arrived within 12 hours of envenomation and their hospital stay was 1-5 days. Among them 1 died since he developed refractory pulmonary edema and ARF (he had more than 100 bites). Five patients had arrived the hospital after 48 hours of bites and their hospital stay was 13- 20 days and all had developed ARF, and most of them also had severe other complications, all

Table-2: Relation of number of wasp envenomation and consequence of presentation

| | <25 N= 1 | 25-50 N= 4, 1 died | 50-75 N= 4 | >75 N= 2, 1 died |
|--------------------------------------|----------|---------------------|---------------------------------|-------------------------|
| Age (Years) | 42 | 31-62 (39.0±16.7) | 14-58 (32.6 ±27.7) | 27-32 (29.5 ±3.5) |
| Sex(M:F) | 1 | 4 | 4 | 2 |
| Days of hospital admission | 3 | 4-13 (7.0 ± 4.0) | 11-20, 1 referred (14.0 ± 10.4) | 1-17; 1 died (9 ± 11.3) |
| Duration from bite to reach hospital | 1.5h | 5h-12d (131± 238 h) | 16h-6day (21.3±4.6 d) | 4h-6 d (51±63.6 h) |
| Rhabdomyolysis | 1 | 1 | 4 | 2 |
| hemolysis | 1 | 2 | 4 | 1 |
| Liver injury | 0 | 3 | 4 | 0 |
| ARF | 0 | 3 | 4 | 2 |
| Myocarditis | 0 | 0 | 1 | 1 |
| Coagulopathy | 0 | 3 | 2 | 0 |
| Pulmonary edema | 0 | 0 | 2 | 1 |
| Secondary HTN | 0 | 4 | 4 | 1 |
| Dialysis done | 0 | 2 | 4 (1 referred) | 1 |
| died | 0 | 0 | 1 | 1 |
| septicemia | 0 | 1 | 0 | 0 |
| HIV | 0 | 0 | 1 | 0 |

Table-3: Duration from bite to reach hospital and the clinical co-morbidities

| | <12h (N= 4) | 12-24h (N=1) | 24-48h (N=1) | >48h (N=5) |
|----------------------------|-----------------------|--------------|--------------|-----------------------|
| Age | 23-62 (39.75±16.7) | 58 | 40 | 14-27 (24.5 ± 7.3) |
| Sex(M:F) | 4 | 1 | 1 | 5 |
| Days of hospital admission | 1-5 (3.25±1.70) | 2 | 6 | 13-20 (17.5±3.31) |
| No of wasp bites | 45.75±38.7 | 58 | 26 | 53.7±21.3 |
| Rabdomyolysis | 2 | 1 | 1 | 4 |
| hemolysis | 1 | 1 | 1 | 5 |
| Liver injury | 2 | 1 | 1 | 3 |
| ARF | 1 | 1 | 1 | 5 |
| Myocarditis | 0 | 1 | 0 | 1 |
| Coagulopathy | 2 | 1 | 1 | 1 |
| Pulmonary edema | 1 | 0 | 0 | 3 |
| Secondary HTN | 2 | 1 | 1 | 5 |
| Dialysis done | 0 | Referred | 1 | 5 |
| died | 1(100 bites) | 0 | 1 | 0 |
| septicemia | 0 | 0 | 0 | 1 |

underwent dialysis (Table-3). Table-3 demonstrated that patients reaching the hospital earlier after the mass envenomation had significant shorter hospital stay and less severe complications.

DISCUSSION

The typical hymenopteran stinging event occurs when a single insect, usually a wasp, is disturbed while searching for food. This usually occurs in the late summer and in early fall, when large numbers of hungry wasp are attracted to the food of humans eating outdoors.³ Any wasp will sting in defense if it is accidentally stepped on, swatted, or otherwise disturbed. In contrast, mass envenomations occur when stinging insects respond to a human intruder as a threat to their colony. Typically, this happens when someone inadvertently stumbles into a colony or otherwise disturbs the structure in which they live (e.g., by throwing rocks at, shooting at, or chopping a tree containing the colony), whereupon hundreds or thousands of stinging insects may issue forth in defense. The circumstances, number, and pattern of stings are helpful clues in identifying the species. Of course, an individual insect of any group may sting if injured or threatened. In temperate climates, stings may occur during any warm month, but their numbers peak in August.⁴

In this study all the wasp bites occurred because of trying to destroy the nests (aerial and ground) or disturbance

of an established nest, which occur during routine yard work, raking, or trimming bushes. Almost all mass envenomations occurred during the mild-to-warm months (March-September) of the year.

Fatal stings usually occur in the head or neck; death typically occurs from hypotension, laryngeal edema, or bronchial constriction within 1 hour, and the typical victim is over 40 years of age, with arteriosclerosis playing a contributing role.⁵ Less commonly, death occurs from the toxic effects of massive envenomation involving hundreds to thousands of stings.

The pathogenic mechanisms responsible for the clinical sequelae following wasp bites include allergic reactions, rhabdomyolysis, hemolysis and direct tissue toxicity. In hypersensitive individuals the complications can range from non-fatal skin eruptions and non-specific urinary abnormalities to fatal anaphylaxis. The major causes of renal failure are acute tubular necrosis due to hypotension or pigment nephropathy resulting from rhabdomyolysis and intravascular hemolysis, and acute interstitial nephritis.⁶ Renal failure has resulted from stings ranging from 22 to 1000. The ARF due to wasp sting bites toxic principles include active amines like histamine, serotonin, kinins, phospholipase A2, hyaluronidase, mellitin and apamine.^{7,8} Phospholipase A2 is believed to trigger the release of arachidonic acid from lipid in the cell membrane which initiates production of inflammatory eicosanoids. Hyaluronidase

in the venom causes breakdown of chondroitins and hyaluronic acid in the connective tissues facilitating spread of venom.⁷ The exact mechanism of rhabdomyolysis is not known but a direct toxic effect of venom on muscle is believed to be the main cause.⁹ The manifestations other than renal failure include myocarditis and myocardial infarction, centrilobular necrosis of liver, and thrombocytopenia as a result of direct platelet toxicity.^{10,11}

Different studies clearly demonstrated that fatalities are typically the result of renal failure due to hemolysis, myolysis, and the ensuing renal damage; or from cardiac arrest due to complications of the venom toxicity. These complications depend on the number of wasp stings and the initiation of aggressive managements. However death may occur within 4 hours to 9 days of wasp stings.¹² In a review of previously reported 12 cases of wasp stings hemolysis and rhabdomyolysis were observed in 10 out of 10 evaluated cases and 7 out of 7 evaluated cases

respectively (Table-4). Abnormal liver function tests were observed 6 out of 7 evaluated cases and all the renal biopsies showed ATN.¹³ Initial management includes removal of stings at the earliest with initiation of alkaline diuresis.¹⁶ When progressive renal failure ensues, intensive dialytic support results in good renal recovery with return of renal functions to normal in majority of the survivors. Table 4 summarizes the case reports published over the last three decades.

In our study 2 patients died during the course of treatment, they had developed refractory pulmonary edema and had more than 75 enumeration of wasp although they had reached the hospital very shortly after the enumeration. So, wasp stings victim's prognosis depends upon the number of wasp stings and the duration to reach the Hospital following the wasp stings agrees with the report of Vetter *et al* 1999.¹² Present study showed that if the patients had less numbers of wasp envenomation they had shorter duration of hospital stay

Table-4: Summary of 13 evaluated cases¹³

| Authors | No. of case | Hemolysis | Rhabdomyolysis | Abnormal LFT | Renal biopsy | Dialysis | outcome |
|--|-------------|-----------------|----------------|---------------|--------------------------------------|----------|--|
| Suprija <i>et al</i> ; 1972 | 1 | Not evaluated | Yes | Not evaluated | ATN | Yes | Recovered |
| Chuga <i>et al</i> | 1 | yes | Not evaluated | Not evaluated | ATN | No | Recoverd |
| Loasurabut V <i>et al</i> ; 1982 | 1 | Yes | Not evaluated | Not evaluated | Not done | No | Died |
| Bousque <i>et al</i> ; 1984 | 1 | Yes | Yes | Yes | Not done | Yes | Recovered |
| Sakhuja <i>et al</i> 1988 | 5 | Yes | Yes | Yes | ATN | Yes | 3 Recovered/ died 2 |
| Barsss P; 1989 | 1 | Yes | Not evaluated | Not evaluated | Not done | No | Died |
| Thiruventhiran T <i>et al</i> ; 1998 | 1 | Yes | Not evaluated | Yes | ATN | No | Recovered |
| Paril PL <i>et al</i> ; 2004 | 1 | Not evaluated | Not evaluated | No | ATN | Yes | Recovered |
| Chao YW <i>et al</i> ; 2004 | 1 | Yes | Yes | Yes | ATN and tubulointerstitial nephritis | Yes | Recovered |
| Atmaram VP <i>et al</i> ; 2004 | 1 | Yes | Yes | Yes | Not done | Yes | Recovered |
| Vikrant Set <i>al</i> ; 2005 ¹⁴ | 3 | 2 yes / 1 no | 2 yes/ 1 no | Yes | Not done | Yes | 2 recovered / 1 died |
| Bhatta N <i>et al</i> ; 2005 ¹⁵ | 2 | Yes | Yes | Yes | ATN / tubulointerstitial nephritis | Yes | 1 recovered/ lost follow up |
| Present case, 2007 | 11 | 8 yes / 3 no | 8 yes/ 3 no | 7 yes 4 no | Not done | yes | 9 Recovered/ 2 died/ 1 lost follow up |

and less severe complications which also agrees with earlier report.¹⁶

The management of wasp bites includes removal of stings at the earliest with initiation of alkaline diuresis and when progressive renal failure ensues, intensive dialytic support results in good renal recovery with return of renal functions to normal in majority of the survivors.

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