

## Case Report

# Yellow jacket envenomation-related acute renal failure

Stalin Viswanathan<sup>1</sup>, Chaitanya Prabhu<sup>2</sup>, Jayanthi Arulneyam<sup>3</sup>, Bhavith Remalayam<sup>1</sup> and Mohammed Adil<sup>1</sup>

<sup>1</sup>Department of Internal Medicine, Pondicherry Institute of Medical Sciences, Kalapet, Pondicherry, South India, <sup>2</sup>Department of Nephrology, Pondicherry Institute of Medical Sciences, Kalapet, Pondicherry, South India and <sup>3</sup>Department of Neurology, Pondicherry Institute of Medical Sciences, Kalapet, Pondicherry

Correspondence and offprint requests to: Stalin Viswanathan; E-mail: stalinviswanathan@ymail.com

### Abstract

We report a 58-year-old man with multiple yellow jacket stings who developed urticaria, renal failure, quadriparesis, rhabdomyolysis in succession. Investigations revealed renal and hepatic dysfunction, proteinuria, demyelinating polyradiculoneuropathy, acute tubular necrosis and glomerulonephritis. He improved with methylprednisolone, antihypertensives and two sessions of haemodialysis.

**Keywords:** hymenoptera venom; quadriparesis; renal failure; yellow jacket envenomation

### Introduction

Hymenoptera are the commonest stinging insects causing allergic reactions. The order Hymenoptera consists of the Vespidae, Apidae (bees) and Formicidae (ants) families. Yellow jackets belong to the Vespidae family, which comprise the genera *Vespula* (ground-nesting yellow jackets), *Dolichovespula* (aerial-nesting yellow jackets), *Vespa* (hornets) and *Polistes* (paper wasps) [1]. We report a delayed allergic reaction in the form of acute tubular necrosis, focal segmental glomerulonephritis and polyradiculoneuropathy in a 58-year-old man following multiple yellow jacket stings.

### Case

This man was admitted following multiple (25–30) yellow jacket stings (Figure 1). Save urticaria and tachypnoea, the examination was normal. Intravenous hydrocortisone and chlorpheniramine were instituted. His investigations included urea 27.48 mmol/L, creatinine 221 µmol/L, SGOT 541 U/L, SGPT 651 U/L, alkaline phosphatase 106 U/L, serum protein 55 g/L, serum albumin 33 g/L, total counts  $18.1 \times 10^9$  with  $N_{50}L_{28}E_{19}M_3$ , platelets  $2.5 \times 10^9$ , haemoglobin (Hb) 144 g/L, IgE 500 U/L, creatine kinase (CK) 350 U/L, CK-MB 55 U/L, negative troponin I, calcium 1.9 mmol/L and phosphorus 2.09 mmol/L. Dipstick

albumin 3+, red blood cells 2–3, pus cells 10–12/hpf and a 24-h urine protein of 216 mg was observed. Urine myoglobin (Mb) and Hb were negative. On Day 2, he developed neck weakness and flaccid quadriparesis (4/5). Nerve conduction studies showed polyradiculoneuropathy, and methylprednisolone (1 g/day  $\times$  3) was administered. During methylprednisolone therapy, he developed rhabdomyolysis; CK and lactate dehydrogenase levels were 8040 and 4630 U/L, respectively, while urine revealed no pigments (Mb/Hb). His creatinine worsened to 1016.6 µmol/L on Day 10. Ultrasonogram revealed bilateral pleural effusion, ascites and normal kidneys. Biopsy was performed on the 13th day after two haemodialysis sessions. At discharge, his creatinine was 380.16 µmol/L. Biopsy revealed a picture of acute tubular necrosis (Figure 2). On follow-up 2 weeks later, his creatinine was 106.8 µmol/L and he required only 5 mg of amlodipine for his hypertension.

### Discussion

Hymenoptera sting reactions are classified as local, systemic and unusual. Local reactions are type IV hypersensitivity IgG-mediated reactions and are either focal or large local; systemic reactions are IgE-mediated type I hypersensitivity reactions and are graded from I to IV depending on the presence of one of the following: urticaria, angioedema, airway obstruction or anaphylaxis [2]. Unusual reactions that are IgG- and IgM-mediated type III hypersensitivity reactions include vasculitides, central nervous system signs or symptoms like seizures and cerebrovascular events, haemolytic events and acute renal failure. About 0.3–4% of people stung develop systemic reactions although they are frequently under-reported. More than 10 species of vespulae are known. A single sting from a yellow jacket can deliver 10–100 µg of venom [3]. Our patient had peripheral blood eosinophilia and elevated total IgE levels. Venom-specific IgE testing was not available at our hospital.

The common yellow jacket's (*V. vulgaris*) allergens have been named Ves v1, Ves v2, Ves v3 and Ves v5 for phospholipase, hyaluronidase, dipeptylpeptidase and

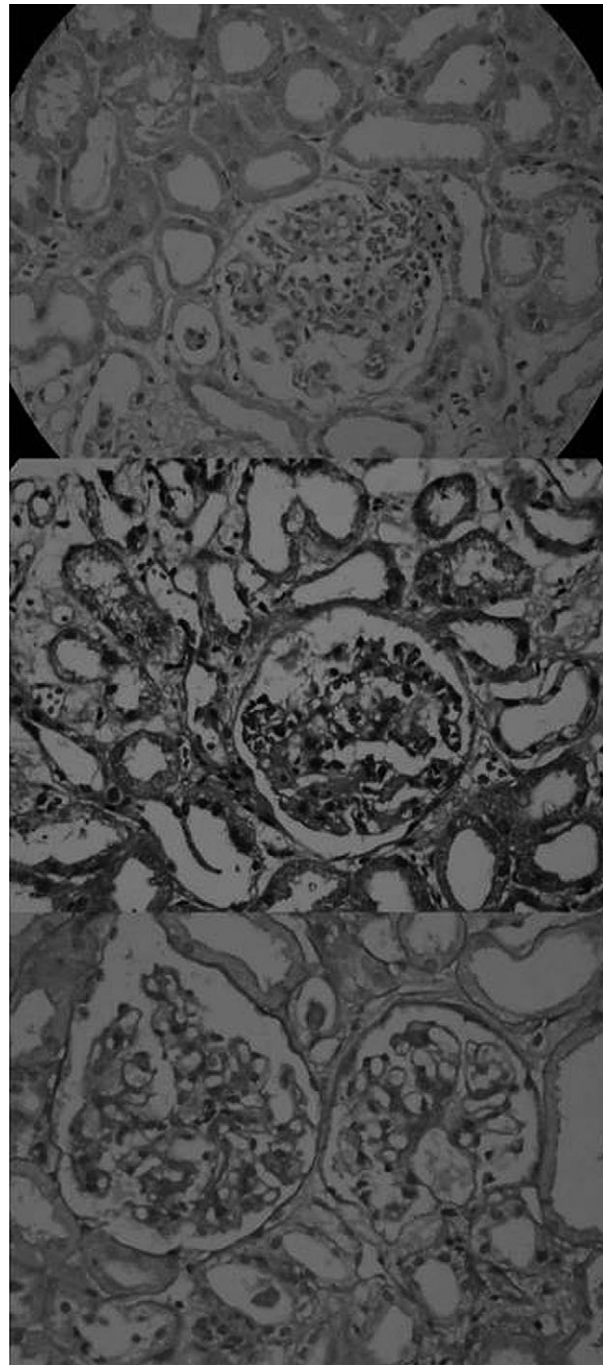


**Fig. 1.** *Vespa* species; picture by Richard Bartz under Creative Commons license.

antigen 5, respectively. The other species of yellow jackets include *V. flavopilosa*, *V. germanica*, *V. maculifrons*, *V. pensylvanica* and *V. squamosa*. These species have only three allergens—without the dipeptylpeptidase [3]. Vespid proteins contain acetylcholine, serotonin, kinins, dopamine, histamine, mast cell degranulating peptide and antigen 5 [2, 4]. Patients often have multiple allergies to stinging insects. There is 92% sequence identity between the yellow jacket and hornet hyaluronidase and 69 and 67% sequence identity between the antigen 5 and phospholipase A1 of the above two genera, respectively [5]. Yellow jackets show ‘delirium behavior’ during late autumn and can inflict multiple stings [2].

Neurological manifestations are being increasingly reported with hymenoptera stings and include strokes, polyradiculoneuropathy, encephalomyelitis, seizures, tremours, myasthenia gravis and Guillain–Barre syndrome [6]. Acute disseminated encephalomyelitis has been reported once in yellow jacket stings and is a delayed type unusual reaction caused by a probable allergic or autoimmune reaction by one’s own T cells against myelin protein [6]. Quadriparesis alone due to demyelinating polyradiculoneuropathy has been reported in wasp stings but never in yellow jacket envenomation [7]. The weakness had occurred within 24 h and resolved over the next 48 h after methylprednisolone initiation.

Renal failure due to hymenoptera stings is unusual, although as of 2010, ~100 cases (1 yellow jacket, 2 hornets, ~80 bees and 9 wasps) have been reported [8] and have been attributed to pigment nephropathy, rhabdomyolysis, intravascular haemolysis, hypotension, venom-related serum sickness, vasculitis or a direct toxic effect itself [9]. Acute tubular necrosis, acute interstitial nephritis and renal tubular acidosis have been described. Glomerulonephritis has not been reported in hymenoptera stings. Renal failure following yellow jacket envenomation has been reported just once in medical literature, in a 12-year-old child and he



**Fig. 2.** Panels 1, 2 and 3: haematoxylin and eosin, Masson’s trichrome and Periodic acid-Schiff. Mild increase in mesangial matrix and cellularity in the visible glomerulus. Few tubules with nuclei loss, basement membrane breach and eosinophilic casts. Interstitium is unremarkable. There are no granulomas or inclusion bodies.

had developed red urine within 2 h of the incident [10]. Our patient had no urinary symptoms whatsoever, although his creatinine 4 h after admission was 221  $\mu\text{mol/L}$  and was stable for the next 3 days until rhabdomyolysis.

In conclusion, we report an unusual case of yellow jacket sting with an initial IgE-mediated large local reaction, followed by rapid onset renal failure due to acute tubular necrosis and delayed onset rhabdomyolysis (on steroid

therapy) that further worsened his renal dysfunction. An average victim of yellow jacket envenomation can have type I, III and IV reactions at the same time: hence a detailed examination and a longer period of observation may be necessary in the emergency room.

*Conflict of interest statement.* None declared.

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*Received for publication: 1.2.11; Accepted in revised form: 9.2.11*