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### Case report

# Poisoning by toxic animals in China—18 autopsy case studies and a comprehensive literature review

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#### ABSTRACT

Although exposure to animal venom and poison, such as snakebites, bee stings, and contact, with toads, is a common problem, reported deaths are rare. The present report discusses 18 fatal cases in China. Causes of death were grouped into 6 categories, including 1 case of tetrodotoxin poisoning, 1 case of gallbladder poisoning, 3 cases of snake venom toxicity, 4 cases of melittin toxicity, 4 cases of cantharidin poisoning and 5 cases of venenum bufonis poisoning. The epidemiology of each venom-induced death, the mechanism of exposure to venom, and the target organs and tissues affected by these toxic animals were here systematically reviewed. Such details are important to even suspected cases of venom damage. The associated problems related to forensic medicine, such as manner of death and possible attribution to the toxic effects of various animals, are also discussed herein.

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Poisoning is a significant global public health problem. According to WHO data, an estimated 346,000 people died worldwide in 2004 from unintentional poisoning. Of these deaths, 91% occurred in low- and middle-income countries [1]. Poisoning incidents have a tremendous impact on families and society. The Ministry of Health of the People's Republic of China posts poisoning cases every year. In 2012, the network system recorded 174 events of food poisoning; out of 6685 poisonings, 146 people died (a number of events involved more than one person). The fatalities caused by food poisoning from the consumption of poisonous animals, plants, and mushrooms accounted for the largest proportion (99/146, 67.8%). From 2000 to 2011, there were a total of 881 reported events of food poisoning from toxic plants and animals, in which 19,605 people were poisoned, and 941 people died. In comparison to chemical and microbial food poisoning, the proportion of events and number of poisoning cases from the consumption of toxic plants and animals is lower, but the number of deaths is higher [2,3]. In 1988, we reported 19 Chinese autopsy cases of poisoning by toxic plants and described the forensic autopsies [4]. In fact, poisoning by toxic animals, including puffer fish, snakebites, bee stings, and fish gallbladders are also common in China. In China, Japan, several Southeast Asia countries, and Australia, incidents of tetrodotoxin (TTX) poisoning occur frequently, mainly from the ingestion of poisonous puffer

fish flesh, viscera, skin, or fish roe [5–8]. According to the available data, 116 incidents of puffer fish poisoning occurred in Japan from 2002 to 2006, which involved 223 patients and 13 deaths [9]. In Singapore, a total of 53 patients with a history of puffer fish ingestion were admitted to a regional hospital from 2001 to 2006; eight of the patients died [10]. In Taiwan, there were 30 TTX intoxication outbreaks from 1994 to 2003 with 124 patients and 8 deaths [9,11]. A more recent outbreak of TTX poisoning occurred in Bangladesh in 2008 involving 141 patients, and 17 died [12]. There are approximately 50 types of puffer fish in the coastal and Yangtze River areas of China. Statistics from China for Jiangyin city revealed 29 puffer fish poisoning events from 1977 to 2007, which poisoned 312 people and killed 12 [13].

Snakebites are a public health issue in many tropical and subtropical countries. Approximately 5 million snake bites occur each year, resulting in up to 2.5 million poisonings and at least 100,000 deaths [14,15]. Fish gallbladder has long been used as a folk remedy for various ailments in China. This type of poisoning occurs primarily in China, occasionally in Japan, and rarely in other countries [16–18]. The majority of these cases have been reported in Chinese journals. Bee venom poisoning is accidental. According to reports, an average of 79.5 animal-related fatalities occurs annually, accounting for 713 deaths from 1999 to 2007 in the USA. The most common fatalities involved contact with hornets, wasps, and bees [19]. In China, there are approximately 200 types of wasps, including the vespidae, wasp, and hornet.

In this article, we will report 18 poisoning cases caused by poisonous animals. We classified these poisonings into six sections. The basic demographic data, clinical manifestations,

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**Table 1**  
Eighteen cases of lethal animal venom toxicity in China.

Category	Case	Gender	Age (y)	Poisoning manner	Clinical course	Time of death	PMI (h)	Autopsy findings	Manner of death	Toxicology
Tetrodotoxin poisoning	Case 1	F	3	Ingestion of dried puffer fish	Dizziness, vomiting, breathing difficulty, coma	4.5 h	19	Internal organ congestion and edema, focal hemorrhage, and inflammatory cell infiltration	Accident	Y
Gallbladder poisoning	Cases 2	F	38	Ingestion of gallbladder	Nausea, vomiting, diarrhea	10 days	24	Toxic nephropathy, liver toxicity	Accident	N
Snake venom toxicity	Case 3	M	43	Bitten on foot back	Irritability, vomiting, dizziness, vision loss	5 days	36	Toxic shock and multiple organ damage	Accident	N
	Case 4	M	4	Bitten on foot malleolus medialis	Treated with acupuncture, anti-venin, irregular pulse, tidal breathing	48 h	36	Foot diffuse subcutaneous hemorrhaging, internal organ congestion and edema	Accident	N
	Case 5	F	36	Injected with snake venom	Numbness, blurred vision, vomiting	5 days	14	Multiple organ damage	Homicide	N
Melittin toxicity	Case 6	F	7	Stung by bees	Skin reddening and swelling, bee sting terebras in the scalp	0.5 h	29	Multiple organ congestion and edema, anaphylactic shock	Accident	Y
	Case 7	M	4	Stung by bees	Facial swelling, cyanotic lips and nails	0.5 h	23	Anaphylactic shock, accidental suffocation	Accident	Y
	Case 8	M	13	Stung by wasps	Coma with severe cerebral edema, dark brown urine	5 days	36	Stung skin necrosis, acute cellulitis, acute tubular necrosis	Accident	N
	Case 9	M	47	Stung by wasps	Stung by a wasp in head, rapid-onset coma	0.5 h	40	Anaphylactic shock, acute laryngeal edema	Accident	Y (IgE)
Cantharidin poisoning	Case 10	F	21	Ingested poison for private abortion	Vomiting, abdominal pain, weakness, coma, moist rales	24 h	36	Toxic nephropathy and mild toxic hepatopathy	Accident	Y
	Case 11	F	18	Ingested poison for private abortion	Abdominal pain, diarrhea, vomiting and severe chills	60 h	24	Toxic nephropathy and mild toxic hepatopathy	Accident	Y
	Case 12	F	54	Ingested poison for treatment	Throat and stomach burning, vomit blood, abdominal pain, hematuria, oliguria	60 h	3	Multiple organ congestion and edema	Accident	Y
	Case 13		28	Ingested poison for treatment over the course of 3 days	Abdominal pain, vomiting with blood, red urine	3 days	17	Toxic nephrosis and acute toxic nephropathy, multiple organ congestion and edema	Accident	Y
Toad-venom poisoning	Case 14	M	42	Eat for bet with people	Drowsiness and abdominal pain, coma after 3 days, arrhythmia with a galloping rhythm and rales in lungs	48 h	4	Toxic nephrosis and acute toxic nephropathy, multiple organ congestion and edema	Accident	Y
	Case 15	M	7	Drank clay pot	Suffered vomiting,	4 h	5	Cyanotic lips and nails.	Accident	Y
	Case 16	F	7	toad soup	tongue numbness,			hydropic degeneration of internal organ		
	Case 17	F	9		abdominal distension,			(cardiac myocytes, hepatocytes, and renal proximal tubule epithelial cells, as well as lung, spleen)		
	Case 18	F	11		abdominal pain, diarrhea within 30 min					

and forensic pathological diagnoses are summarized in Table 1. Of these cases, nine were autopsied by the authors, and the other nine cases were autopsied by other forensic medical examiners in China. The discussion will focus on analyzing the mechanism of death caused by poisoning from toxic animals. The target organs or tissues affected by toxic animals determines the basis of the symptoms, the pathological changes and the toxicological analysis, and the associated problems related to forensic medicine, such as the cause of poisoning, are also discussed in combination with a comprehensive review of the literature.

## 1. Case reports

### 1.1. Tetrodotoxin poisoning

#### 1.1.1. Case 1

A 3.5-year-old girl shared one piece of dried puffer fish with her 26-year-old mother. One hour later, she was dizzy, had difficulty breathing, and vomited, and her lips, tongue, and limbs were numb. Gastric lavage treatment was performed after she was sent to the hospital. Three hrs later, she fell into a coma and was

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