

Prompt Procedures Have a Great Impact on the Consequences of Asiatic Black Bear Mauling

Goh Akiyama¹, Hiroaki Kuwahara², Rintaro Asahi²,
Ryoichi Tosa¹ and Hiroyuki Yokota³

¹Department of Emergency and Critical Care Medicine, Aizu Chuo Hospital, Fukushima, Japan

²Department of Plastic, Aesthetic and Reconstructive Surgery, Nippon Medical School Hospital, Tokyo, Japan

³Department of Emergency and Critical Care Medicine, Nippon Medical School, Tokyo, Japan

Introduction: Although bear-inflicted human injuries are rare and the mortality rate of the injuries is usually not high, the chances of bear-human interactions have been increasing, with fatal cases being reported in Japan every year. The aim of this study was to report a series of bear-inflicted injuries and discuss their management and severity.

Materials and Methods: A retrospective study was performed at the emergency and critical care center of Aizu Chuo Hospital, a tertiary care center in Japan, from May 2013 to September 2015. During this period, we encountered 14 black bear injury patients (12 men and 2 women).

Results: Six victims were attacked in dense forests while collecting wild vegetables; 4 victims were attacked near their houses. Lacerations of the scalp and face were the most frequent injuries, affecting 13 patients. Three patients developed hemorrhagic shock. Injury severity scores ranged from 2 to 12 (median value, 6). None of the injuries was fatal. Thirteen patients were transported by the local fire department's ambulances, 9 of whom were transferred to doctor ambulances.

Conclusions: Although the severity and mortality rate following bear-inflicted injuries are not high, these encounters usually take place in remote rural areas, so a delay in rescue and proper care can lead to the incident becoming fatal. Hence, early decisions and arrangements for patient transportation to a tertiary care center and prompt measures to save lives will have a positive impact on the consequences of such incidents. (*J Nippon Med Sch* 2017; 84: 294–300)

Key words: trauma, shock, pre-hospital care/medical control

Introduction

Although encounters with black bears are rare, the likelihood of bear-human interactions has increased recently. Studies on human injuries as a result of bear attacks are few, and there is only one published case report in the English literature on Asiatic black bear mauling in Japan¹. Here, we describe and review fourteen Asiatic black bear attacks that occurred in the Aizu area of Fukushima, Japan, including the pattern and severity of injury and the circumstances under which they occurred. The aim of this study was to report a series of bear-inflicted injuries and discuss their management, severity, and complications.

Materials and Methods

A retrospective study was performed at the emergency and critical care center of Aizu Chuo Hospital, which is a tertiary care center in Japan. We reviewed all bear-attack patients who presented to our institution between May 2013 and September 2015.

We identified 14 such patients. Their records were retrospectively reviewed and a detailed history was obtained, including activity preceding the attack, region where the incident occurred, date of attack, patient demographics, severity of injury, surgical procedures required, and complications. Consent for reporting their cases was individually obtained from each of the pa-

Correspondence to Goh Akiyama, MD, Department of Emergency and Critical Care Medicine, Aizu Chuo Hospital, 1-1 Tsurugamachi, Aizuwakamatsu, Fukushima 965-0011, Japan

E-mail: s9003@nms.ac.jp

Journal Website (<http://www2.nms.ac.jp/jnms/>)

Table 1 Case reports of Asiatic black bear-inflicted injuries

Case no.	Age/sex	Time and Month	Locations of attack	Injured body parts	DA called
1	77/F	9 a.m., May	Mountain	Scalp, face, right forearm, right thigh	
2	71/M	7 a.m., May	Mountain	Scalp, face, both hands	+
3	88/M	8 a.m., August	Crop field	Scalp, face, both forearms	+
4	64/M	2 p.m., September	Mountain	Face, right arm, left thigh	+
5	49/M	1 p.m., May	Mountain	Scalp, face, lower back	+
6	62/M	6 a.m., July	Urban area	Scalp, both forearms, left knee	+
7	56/F	6 a.m., July	Urban area	Both arms and legs	+
8	29/F	6 a.m., July	Urban area	Scalp, face, right forearm	+
9	64/M	12 a.m., December	During bear-hunting	Scalp, face, neck, both forearms	
10	64/M	9 a.m., May	Mountain	Face, right forearm, left thigh	
11	86/M	6 a.m., August	Mountain	Scalp, face, right upper arm	
12	39/M	1 a.m., August	Urban area	Scalp, face, right leg, anterior chest	+
13	71/M	5 a.m., July	Crop field	Face, anterior chest, left thigh	
14	54/M	7 a.m., May	Mountain	Face, right arm, right thigh	+

DA: Doctor ambulance

Table 2 Initial procedures and complications in each case

Case no.	Initial procedures	Complications
1	External fixation for right distal radial fracture	Subcutaneous abscess of the scalp Numbness around the wound
2	Hemostatic therapy, fluid resuscitation Closed reduction of nasal bone fracture Percutaneous pinning of the metacarpal bone	Numbness around the wound
3		Severely reduced visual acuity Fused eyelid
4	Nasolacrimal duct reformation	
5	Hemostatic therapy, fluid resuscitation	Psychological trauma Numbness around the wound
6	Hemostatic therapy, fluid resuscitation	Deformation of auricle
7	External fixation for left distal radial fracture	Subcutaneous abscess of lower leg
9	Open reduction for maxillofacial fracture	Cicatricial contracture of the face
10		Raw area over right forearm requiring skin graft
13		Raw area over left thigh requiring skin graft
14		Cicatricial contracture of the face

tients. Ethics committee approval was not obtained for this study, as it was deemed 'not required' by our hospital director.

Results

Fourteen Asiatic black bear mauling patients (12 men and 2 women) were treated at our hospital during the study period of 31 months. Twelve of the attacks occurred between the summer months of May and August. The ages of the patients ranged between 29 and 88 years (median age, 62 years). Ten attacks occurred early in the morning between 5 a.m. and 9 a.m. Six victims were attacked in dense forests while collecting wild vegetables, 4 were attacked near their houses, and 2 while working in crop fields (Table 1 and 2).

Deep lacerations of the scalp and face were the most common findings, affecting 13 patients. Forearm (2 cases), facial (2 cases), upper limb (1 case), and hand (1 case) fractures were a striking observation. Three of the patients developed hemorrhagic shock. Seven needed emergency surgery under general anesthesia (GA). Wound infection was seen in 2 patients, and long-term psychological trauma was seen in 2.

The severity of injuries was not high in any of the patients, with injury severity scores (ISS) ranging between 2 and 12 (median value, 6). The revised trauma score (RTS) ranged from 7.11 to 7.84 (median value, 7.84). The probability of survival was 97.8%±1.12 (average±S.D.). There were no fatalities (Table 3).

Most of the patients (13) were transported by ambu-

Table 3 Severity of each case

Case no.	AIS code				ISS
	Head-Face	Upper Extremity	Lower Extremity	Other	
1	2	1	1		6
2	2	1		1	6
3		1	1		2
4	2	1	3		14
5	1	1		1	3
6	2		1		5
7			3		9
8	1	1	1		3
9	1	2	1		6
10		1	1		2
11	2	2	2		12
12	1	2	2		9
13	1	1	1		3
14	1	1	3		11

AIS: abbreviated injury scale, ISS: injury severity score

lance. In nine of these cases, a doctor ambulance (DA) was sent out to the delivery route of the ambulance of the local fire service (Table 1).

All the patients were hospitalized and treated according to the Japan Advanced Trauma Evaluation and Care (JATEC) guidelines. Copious irrigation and debridement of the wounds was immediately performed. We routinely administered parenteral antibiotics (cephalosporin and clindamycin). Tetanus prophylaxis was given to unimmunized patients. We did not give anti-rabies vaccines to any of the patients, because there have been no reports of rabies infections in Japan for over 60 years.

The clinical courses of typical cases were as described below.

Case 1

At approximately 9 a.m. one morning in the middle of May, a 77-year-old woman was attacked by an Asiatic black bear while she was with her husband in the countryside near the forest picking some mountain plants. The bear retreated without injuring the husband. The husband brought her in his car to our institution. Her scalp, face, left ear, and right thigh were lacerated, and her right arm was deformed. The patient was assessed, and hematological, biochemical, and radiological investigations were performed. X-rays showed fractures of the right distal radius, ulnar styloid, and third metacarpal bone.

In the emergency room, after copious irrigation and debridement, primary repair of her wounds was performed under local anesthesia. Next, external fixation was performed under GA in the operating room. Antibio-

tic prophylaxis with parenteral cephalosporin and clindamycin was commenced on day 1. By the seventh day, a subcutaneous abscess had formed on her scalp, which needed drainage and debridement. *Enterococcus faecalis* and *Prevotella* species were cultured from the abscess. On the same day, we commenced administration of the antibiotic combination of tazobactam and piperacillin. On the fourteenth day, open reduction and internal fixation of the fractures was performed, using an AO locking compression T-plate (Synthes Ltd., Paoli, PA, USA). The patient was discharged on the fortieth day (Fig. 1). Post-operatively, she complained of numbness around the wound.

Case 2

At 7 a.m. one day at the end of May, a 71-year-old man was attacked by an Asiatic black bear when he was in the forest trying to pick some mountain plants. His scalp, face, and both hands were lacerated. A DA was called by the local fire department. By the time of examination in the DA by the emergency physician, the patient had developed hemorrhagic shock due to active bleeding from branches of the superficial temporal artery, which required fluid resuscitation and a procedure to stop the bleeding.

After his arrival at our institution, emergency investigations, including hematological evaluations, computed tomography scans of the head and face, and an X-ray of both hands, demonstrated a nasal bone fracture and a fracture of the right fourth metacarpal bone. After copious irrigation and debridement of the wounds, primary closure of the wounds, closed reduction of the nasal



Fig. 1 Case 1. A 77-year-old woman was attacked by an Asiatic black bear. The photographs show the scalp lacerations on arrival (upper left). Primary suturing with drainage of a subcutaneous abscess was performed at a later date (upper right). Her appearance at three months postoperatively is shown (lower left, lower right).

bone, and percutaneous pinning of the metacarpal bone were performed under GA in the operating room (Fig. 2). Antibiotic prophylaxis with parenteral cephalosporin and clindamycin was commenced on day 1. The patient recovered well without any infectious complications and was discharged on the twenty-first day. Postoperatively, he complained of numbness around the wound.

Case 3

An 81-year-old man was attacked by an Asiatic black bear when he was sitting in his crop field at approximately 8 a.m. one day at the beginning of August. A DA was called. His scalp, head, and both forearms were lacerated, and his right eyeball was exposed due to avulsion from the right orbital foramen. Fluid resuscitation was started in the DA. After arrival at the hospital, the patient was taken for emergency exploration of his wounds under GA and primary closure was performed. Postoperatively, although he did not have any infectious complications, he had severely reduced visual acuity and

a fused eyelid (Fig. 3).

Case 4

Around 2 p.m. one afternoon at the end of August, a 64-year-old man was attacked by an Asiatic black bear when he was picking some mountain plants with his friend in the mountain. A DA was called. His face, left thigh, and right upper arm were lacerated, and his right nasolacrimal duct was also injured. An avulsion fracture of the right upper arm accompanied the laceration. Exploration and repair of the patient's wounds was performed after irrigation and debridement under GA, together with management of the bone injury and nasolacrimal duct injury (Fig. 4). He was discharged on the sixteenth day without any complications.

Discussion

Black bears live in an arboreal environment, prefer to eat vegetation and carrion, with live prey—consisting of small mammals and insects—comprising less than 5% of



Fig. 2 Case 2. A 71-year-old man presented with bear mauling of his face. His scalp and face were lacerated. The photographs show laceration of the face and the nasal bone fracture after procedures to stop active bleeding from branches of the superficial temporal artery were performed (left); primary closure of the wounds and closed reduction of the nasal bone were performed (right).



Fig. 3 Case 3. An 81-year old man was attacked by an Asiatic black bear. His scalp and head were lacerated and right eyeball was exposed due to avulsion from the right orbital foramen (left). Primary closure of the wounds was performed (right).

their diet. Black bears have sharp, short-radius claws adapted for climbing trees, which provide not only a source of food, but also safety².

The Asiatic black bear (*Ursus thibetanus*, previously

known as *Selenarctos thibetanus*) is also known as the moon bear and white-chested bear³. Asiatic black bears living in Japan, commonly called Japanese black bears, are a small subspecies, with the average adult male

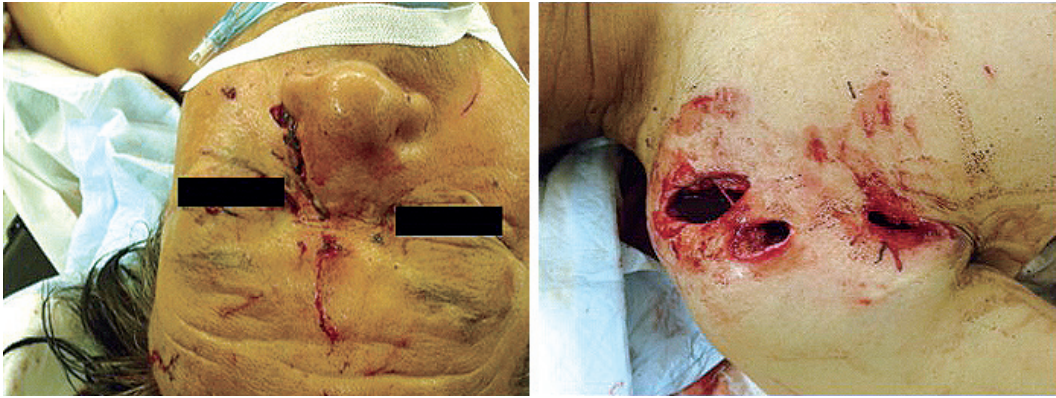


Fig. 4 Case 4. A 64-year-old man presented with injuries resulting from an Asiatic bear attack in the mountains. His face was lacerated and right nasolacrimal duct was also injured (left). His right upper arm was lacerated, together with an avulsion fracture (right).

weighing between 60 and 120 kg, and adult females weighing between 40 and 100 kg. Their average body length is 110–140 cm. These bears lack the thick neck fur of other subspecies and have a darker colored snout^{4,5}.

Fukushima is the third largest prefecture in Japan, and the Aizu region has an area of 5,420 square meters. The total population of Aizu is 276,810, as of January 2016. Those who live in rural areas of Aizu often go into the forest in search of mountain plants for cooking, which is when they sometimes encounter Asiatic black bears. Our institution is the only tertiary care center serving such a wide area, and it can take as long as two hours for ambulances to transport people to our hospital.

Asiatic black bears usually attack in self-defense, with special predilection for attacking the face, causing minor injuries in some patients, but major fractures and serious disfigurement in others. In addition to biting, a common means of attack by the bear is to slap the head and facial region of the victim, leading to fractures of the skull and facial bones, extra- or intracranial hemorrhage, hearing loss, respiratory obstruction due to aspiration of blood, and deep lacerations on the face^{6,7}. Hence, depending on their symptoms, all patients should be assessed by X-ray or computed tomography. In our patients, deep lacerations on the scalp and face were the most common findings, affecting 13 of the 14 patients (Table 1).

Bites caused by wild animals may cause local infection, since the wounds are potentially contaminated by a variety of pathogens⁸. The predominant oral flora present in black bears' mouths are sensitive to penicillin⁹. In the current case series, two of the patients developed infections. In case 1, as described above, a subcutaneous abscess formed on the scalp on the seventh day, which needed drainage and debridement. *Enterococcus faecalis*

and *Prevotella* species were cultured from the abscess. The cultured *Enterococcus faecalis* was sensitive to ampicillin (ABPC). In case 7, an abscess formed under the sutured wound in the patient's lower leg on the fifth day. *Serratia marcescens*, *Citrobacter freundii*, and *Enterobacter cloacae* were cultured, all of which were resistant to both ampicillin (ABPC) and cefazolin (CEZ), and hence, ceftazidim (CAZ) was administered instead, as indicated by culture results. Although bear-inflicted injuries are usually not fatal, the bear-human encounters often occur in remote areas, resulting in a substantial delay in notification, rescue, and proper care¹⁰. As fatal exsanguination sometimes occurs when the incidents occur in remote areas¹¹, management of these injuries, including measures to stop bleeding from the wounds, fluid resuscitation, and airway management, should be commenced at the site of the encounter itself⁶ since early aggressive efforts may save lives¹². Transportation of the patient in a DA is beneficial since the emergency physician present in the DA can perform appropriate procedures to save lives at an early stage. In our series, three patients developed hemorrhagic shock and needed fluid resuscitation. In all three cases, a DA was called for.

Although most bears avoid humans¹³, the number of bear-inflicted injuries is increasing in the Aizu area, with an average of 8 encounters per year. Furthermore, the incidence of fatal accidents is an average of one person each year. The increase in human injuries and fatalities due to bear encounters seems to correlate with increased back-country use, decreased forest area, and the strict conservation of wildlife^{6,14}. In addition, defenses against bears in the region have decreased due to depopulation, aging, and decreasing numbers of hunters.

Conclusions

Although bear attacks are usually not fatal, they can lead to complex fractures and disfigurement. Since deep lacerations of the scalp and face seem to be the most common injuries in the victims of these attacks, attending physicians must take care of patients' cosmetic outcomes, as well as providing life-saving treatment. These accidents usually occur in places that are distant from trauma centers, resulting in a substantial delay with respect to notification, rescue, and definitive care. Such delay sometimes leads to a fatal accident caused by respiratory obstruction due to aspiration of blood or circulatory shock. Therefore, early decisions and arrangements for transportation of the patients to tertiary care centers and prompt measures to save lives, including measures to stop bleeding from the wounds, fluid resuscitation, and airway management, will have a positive impact on the late consequences. Management of these patients requires a multidisciplinary approach involving all subspecialties of trauma.

Acknowledgments: The authors are deeply grateful to Takashi Araki M.D., Ph.D., at the Department of Emergency and Critical Care Medicine of Nippon Medical School, for his careful comments, review, and suggestions. We also thank Shuichi Satake M.D., Mariko Omura M.D., and Shin-Ichiro Shiraishi, M.D. at the Department of Emergency and Critical Care Medicine of Aizu Chuo Hospital for helping with data acquisition and providing useful advice.

Conflict of Interest: We declare that we did not receive any funding for this work and that there is no conflict of interest regarding this work.

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(Received, October 7, 2016)

(Accepted, August 24, 2017)