Original Research Article

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Are humans encroaching too much? man versus bear

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ABSTRACT

Background: Uttarakhand is a hilly state inhabited by various wild animals. Human encroachment into the forest areas has increased the encounters between humans and wild animals. Encounters have been on the rise and bear mauling seems to be one of the leading causes of wild animal attacks with grievous results.

Methods: The study was conducted in the Department of Plastic and Reconstructive Surgery, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun, Uttarakhand, India from November 2016 to February 2017. After obtaining written informed consent from the patient a data pertaining to history of injury, time of hospital arrival, number of operative procedures, time of hospital stay, complications were recorded.

Results: The injury timing of bear mauling was maximum during 12pm-8pm in 3 cases. Mean length of hospital stay was 19 days. Three cases (42.85%) of wound dehiscence were due to margin necrosis. Amongst the permanent damages suffered, were loss of vision in one eye in 1 case (14.28%), facial disfigurement in the form of contour deformities in 2 cases (28.57%), ectropion and facial nerve palsy in 1 case (14.28%) and parotid fistula in 1 case (14.28%).

Conclusions: Encroachment and deforestation have led to an increase in injuries caused by the Himalayan black bears. Ominous effects seen in the changing climatic pattern largely due to global warming could be a possibility of causing altered living habitat for the bears in this Garhwal region getting more aggressive day by day.

Keywords: Bear mauling, Deforestation, Global warming, Grievous

INTRODUCTION

Uttarakhand is a state of mountains, hills and plains covered with forests and snow inhabited by various wild animals. With the encroachment of human colonies into the forest areas, there have been several encounters between the humans and the wild animals, and often the results are grievous.

Encounters have been on the rise and bear mauling seems to be one of the leading causes of wild animal attacks. The injuries are very disastrous and leave behind permanent disfigurements and disabilities.

A bear mauling is an attack by any mammal of the *Ursidae* family. Asian black bear (*Ursus thibetanus*), Sloth bear-*Melursus ursinus*) and the Himalayan brown bear (*Ursus arctos isabellinus*) are the species commonly found in Uttarakhand, India.

Bears are not very aggressive animals when left alone but they do attack humans when they are surprised or provoked with threat to themselves or their young ones or when they are hungry. Bears use their arms more than their jaws to attack their victims. Their heavy arm can produce heavy blows with power up to 100 Newton. Injuries vary from small abrasion to devastating and fatal injuries.² Brigadier General R. G. Burton has very nicely described; "the Himalayan black bear is a savage animal, sometimes attacking without provocation, and inflicting horrible wounds... and many have been killed by these bears".³

Bear encounters are categorized as sudden, provoked or predatory. In sudden encounters, neither the person nor the bear is aware of each other's presence till they are in close range of each other. Such encounters are usually defensive in nature whereby the bears try to protect their young ones, their food cache or their territory. Provoked encounters are the second most common type of encounters. Such cases occur with bear hunters and wild life photographers. Hunters who either miss or place an inadequate shot can become a victim of their prey. Predatory attacks are defined as the ones where the bear clearly treats its victim as a food source.⁴

Reports regarding the pattern of injuries caused by bears in humans are scarce in literature, though much has been written on bears, their attacks with various case reports and methods of prevention from such attacks. The Himalayan Institute Hospital is a tertiary care center in Garhwal region at the foothills, and patients with injuries caused by bears are often referred here.

This study is conducted to assess and describe pattern and severity of the injuries sustained due to bear mauling and to emphasize the permanent damage they cause.

METHODS

This was a descriptive study with analysis of all the cases of bear mauling injuries from the month of November 2016 to February 2017. All these cases were managed in Department of Plastic and Reconstructive Surgery, SRH University- a tertiary health care center with multidisciplinary coordination. Data were collected prospectively from November 2016 to February 2017 and then a detailed history was recorded including patient demographics, date and place of attack, type of bear (if known), time from attack to hospital arrival and circumstances leading to the attack.

All examination findings were recorded. Patients were followed through their stay in hospital and pertinent data were recorded like- type and severity of injury, types and number of surgical procedures, length of hospital stay and complications.

Inclusion criteria

All patients of bear mauling injuries reporting to the Himalayan Institute Hospital during the period in

- Plastic surgery and
- Casualty and allied departments.

Exclusion criteria

Patients who suffered injuries while attempting to escape from a bear, i.e. injuries not inflicted by the bear itself.

Relevant points in history and physical examination were recorded using the investigator designed working proforma for bear mauling cases.

For each subject the following routine was followed-

- Detailed history of the incident details was recorded.
- Detailed clinical evaluation of the cases with bear mauling injuries.
- Relevant radiological investigation of the cases.
- Observation of primary, secondary and tertiary level treatment received by the subject.

Any permanent disfigurement in the cases of bear mauling injuries was noted. Microsoft Excel version 2007 was used for data analysis.

RESULTS

The results of present study have involved 7 patients who presented to the Institute in a span of approximately 4 months. The results have been in concordance from the data obtained in the case sheets including complete history, operative notes and issues related to morbidity.

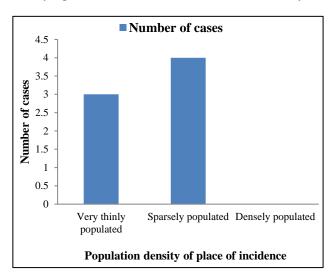


Figure 1: Distribution of patients according to population density of place (n=7).

Out of 7 patients, 4 lived in sparsely populated region, while 3 of them lived in very thinly populated areas (Figure 1).

The injury timing of bear mauling was maximum during 12pm-8pm in 3 cases, which was closely followed by 2 cases sustaining injury between 8am-12pm. 1 case each occurred during the time slot of 12am-8am and 8pm-12am respectively (Figure 2).

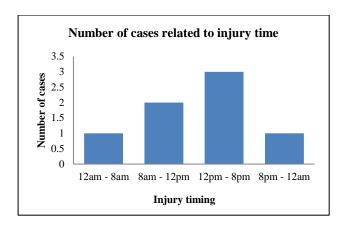


Figure 2: Distribution of patients according to timing of injury (n=7).

Primary suturing was done in 6 cases out of 7. With flap coverage done in 3 cases and SSG coverage in 2 cases. 4 out of 7 cases in the study sustained fractures of underlying facial bones viz. zygomatic, maxilla, frontal, ethmoid bones (Figure 3).

Three cases (42.85%) of wound dehiscence were due to margin necrosis. Amongst the permanent damages suffered, were loss of vision in one eye in 1 case (14.28%), facial disfigurement in the form of contour deformities in 2 cases (28.57%), ectropion and facial nerve palsy in 1 case (14.28%) and parotid fistula in 1 case (14.28%) (Figure 4).

Mean length of hospital stay was 19 days (Figure 5).

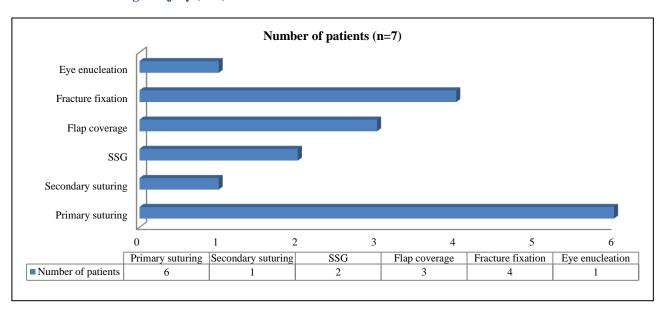


Figure 3: Number of patients undergoing surgical procedures (n=7).

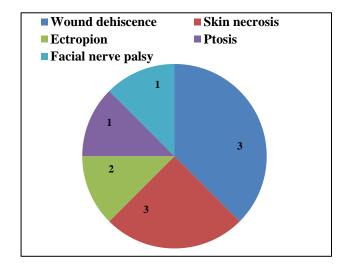


Figure 4: Distribution of post-operative complications in patients (n=7).

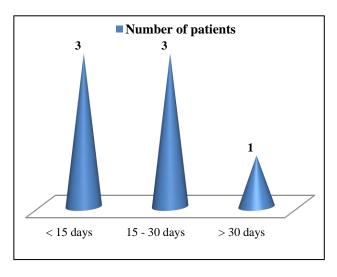


Figure 5: Duration of hospital stay by patients (n=7).

DISCUSSION

The incidences of bear mauling are on a rising trend and the numbers seen in this study are just a tip of the iceberg. There could be unreported mortalities at the site of encounters and majorities of the cases may not have reached tertiary centers. It can be assumed as stated by patients and relatives that many victims are not reaching to hospital for the requisite treatment due to logistic, geographic and financial limitations.

The Himalayan black bear (Asiatic black bear, Ursus thibetanus) inhabits forested mountains between 1200m to 3200m altitudes above sea level and moves in man-altered habitat seeking food during night. Most of the human mauling by black bears is due to man surprising a bear at close quarters. Sudden encounters can be attributed to preoccupation and inattention on the part of both bear and human.⁵ These attacks usually take place in hilly forested areas. Heavy forestation, tall vegetation especially in monsoon, fog, rain and rocky terrain can reduce visibility.6 If a bear is spotted, wild life experts advise the man to retreat, giving time for the bear to move away. Adults of middle age group usually get injured in bear mauling as they are the working and earning hands of the family and go out for farming, collecting fodder for livestock, timber for cooking and other domestic purposes especially in the early morning period resulting in increased incidence of such attacks in the early morning. Females in Garhwal handle farming and other activities like fodder and timber collection for fuel at home resulting in such accidents among females. An interesting observation that most of the attacks involved single human denotes that bears fear humans and attack only when a threat is perceived. Asiatic black bears are active during the monsoon period and come down the forest in search of food where they encounter humans resulting in more attacks during monsoons.⁷

There has been considerable delay in the reporting of the patients to our centre with time duration ranging from 6-48 hours, emphasizing the very fact of the difficulty faced by the patient's attendants in arranging the transportation means.

There are other studies of bear mauling reported from Kashmir, Central India, Canada, and Alaska. In those studies, the majority of patients were middle aged (mean age 37 years) males.

This is in contradiction to the case series of 7 patients, wherein 6 patients were females and the incidence has been related to them for collecting feeds for cattle, firewood, etc as they form the working member of the house with husbands engaged in farming practices. In Uttarakhand, India usually the female members go out to collect fodder for the cattle and firewood for cooking and return in the afternoon or evening hours. Comparing the severity and pattern of injuries with other case reports, it was observed that most of the injuries were grievous and involved the facial structures. With the use of CT scan with

3D-face reconstruction, the extent of injuries to facial skeleton was clearly delineated and henceforth subsequent management was planned accordingly.

One of the patients had got one eye completely eviscerated at presentation, so it was prudent to remove the severed eye at the earliest to prevent sympathetic ophthalmitis of the healthy eye.

Also, one patient had injury to the parotid region, following which the patient had developed facial palsy, in lieu of the fact that her facial nerve was not found to be injured at the time of surgical procedure.

Similarly, one patient with similar injury had developed post operatively parotid fistula, which was meticulously managed.

All victims were haemodynamically stable when received in ER and we had no mortalities in the study. This shows that attacks of the bear were not predatory but defensive/ sudden as found in all of the cases in the study. The black bear and sloth bear are not as aggressive as their counterpart grizzly bear in the west. Comparable supportive findings are seen in study from Kashmir, India where all cases were stable in ER, 92.80% of attacks were a result of sudden encounters, 6.71% were provoked ones and 0.47% was from predatory encounters that lead to 2.39% mortality in 200 cases. Similar findings of more stable patients and low mortality have been reported in other studies.⁸ A review of 500 black bear attacks reports only three fatalities.⁹ Contrary, higher mortalities were found in studies from Alaska and Alberta, showing that Grizzly attacks are much aggressive and prove to be fatal.8 Amongst the mortalities in Alaska, 28 were due to mauling by brown/grizzly bears compared to only three by the black bears.¹⁰

Predominance of head and facial injuries in bear mauling can be explained on the basis that when bear attacks, they use their claws of forelimbs in standing position so as to have a high ground of attack. Sudden encounters are usually face to face, where humans are in erect position and being shorter than the bear in front of them, have their head and face in very vulnerable position to sustain a blow. So, author can infer that it would be a good idea to lie down flat on the ground with both hand covering the head and face when encountered by a bear, to prevent the common facial injuries of bear maul.²

Head and face with their bony and cartilaginous projecting parts are prominent parts of body making them readily available for severe injuries due to bear's paws/claws. Secondly, it can be presumed that bears being highly intelligent animals, often try to weaken their enemy by easily targeting their face so that they may be unable to fight back and harm them. Also bears can easily reach up to a height of 6 feet when standing on their hind limbs which makes the facial region more vulnerable. Viscera being deep seated get involved only due to puncture wound

or when patient has a fall during attack. Upper limbs are injured during a defensive move and lower limbs are injured because they are readily available for a sweep of the paws/claws. In cases of facial injuries caused by the bear, eyes are usually involved. All cases of bear maul with perforating eye injuries should undergo an early enucleation of the eye to prevent sympathetic ophthalmitis. 6

The reconstruction in our patients needed expert plastic and reconstructive services with the cooperation of ophthalmologist, oto-rhinolaryngologist and neurosurgeon. The mid-facial structures- zygomatic, maxilla, nose, pinna, orbit and eyeballs- are high risk areas in bear mauling injuries. In most cases the injury involved a soft tissue-bone complex comprising structures extending from nose in the midline to pinna laterally. These structures were carefully evaluated. The Plastic reconstructive surgeon drew out an action plan in collaboration with other concerned specialists, priorities were chalked out and the action plan was then executed in accordance.

In depth of the wounds, there often is necrotic material, bone chips, grass leaves and debris. A generous debridement of the injured soft tissue to clear the foreign material and debris and freshening of the edges provides an uneventful healing. Inspite of the extensive injuries, the reconstruction of structures provides gratifying results.

In view of multiple fractures, reduction and stabilization with plates/wires is done to achieve best possible union in normal shape.

Not much has been published in the past medical literature on the management of raw areas after bear mauling injuries. Dvivedi S et al in their study on bear mauling injuries stressed the need of grafts and flaps to cover raw areas after debridement to achieve early healing and cosmetically gratifying results. 6 Less number of mortalities after bear mauling can be attributed to the fact that injuries do not involve vital structures. The bears have an instinct to neutralize the intruder and then leave the area. Invariably, the victim is not treated as a source of food, but rather as a perceived threat.4 Bears are short sighted animals and are easily surprised. Psychiatric complications are common following bear mauling in the form of posttraumatic stress disorder (PTSD) which is defined as development of symptoms lasting longer than 1 month following emotional stress associated with trauma. 12

Four out of 7 cases in the study sustained fractures of underlying bones that show the massive power of these blows. In contrast to that, in previous Indian studies not so severe injuries have been documented. Similar findings seen in the study of bear mauling in Alaska where the author found fractures in 50% of cases. More than 50% of cases were associated with fractures in study reviewing case of bear maul in Central India and 45% of which were zygoma fracture. Almost all the cases of fractures found in

the study done in Garhwal, Himalayas involved facial skeleton. A study from Kashmir, India found bony injury (fracture and/or loss) in 31.41% cases and face was most commonly involved site of bony injuries (27.09%).⁴

Eye was found to be the most common viscera, sustaining injury in 59% of victims with permanent vision loss in all the four victims. This finding parallels the findings in study from Central India upon 48 victims, where 14 cases of eye injuries had been documented with blindness in 4 cases. Many more case reports of bear maul to eyes can be seen in the literature.⁷

Various types of injuries were encountered requiring the use of various steps of reconstructive ladder. Author had more proportion of patients with complex wounds requiring initial debridement followed by coverage with skin graft, flaps than the simple wounds which were just debrided and closed with primary or secondary suturing. In contrast to reports from Central India, which had more of the simple wounds that were sutured (48) and only nine of them needed flap surgery.⁸

Author had just three cases (42.85%) of wound dehiscence, which was because of margin necrosis. Amongst the permanent damages suffered, were loss of vision in one eye in 1 case (14.28%), facial disfigurement in the form of contour deformities in 2 cases (28.57%), ectropion and facial nerve palsy in 1 case (14.28%) and parotid fistula in 1 case (14.28%).

Mean length of hospital stay was 19 days in the initial treatment period similar to that seen in studies from Central India with 21 days and Canadian study with 22 days. ¹⁰ Average number of operation undergone by the victims was two, similar to that found in other study. ⁸ Study from the west reports three surgeries per case of bear maul injury. This is probably due to more complex injuries by grizzly bear and it also included subsequent scar revision procedures which are very unlikely in the part of the world where it may not be affordable by the patient and are of less priority and poor follow up. ¹⁰

CONCLUSION

Encroachment and deforestation have led to an increase in injuries caused by the Himalayan black bears. All cases of bear inflicted injury should be considered grievous. Bear attacks usually involve young adults of both sexes equally. Most of these encounters occur in dense forested hilly areas at altitudes of 1200m-3200m. People working in the dense forests and fields or all those who happen to pass by these forests are at increased risk of encountering a bear. Most of these bear human encounters involve a single party on both sides. Most encounters occur in rainy season in the early morning hours. Bear attacks are sudden encounters and are not intended for predatory purpose.

Although in present study author observed that in winter season too, there was a paradigm shift. This can be attributed to the mass scale deforestation being done in the state with obvious ominous effects seen in the changing climatic pattern largely due to global warming, could be a possibility of causing altered living habitat for the bears in this Garhwal region getting more aggressive day by day.

Also, patients come from poor socio-economic strata, hence when the expenditure is to be incurred by the relatives, Forest department re- imbursement issues had cropped up leading to delay in planning with the treatment aforesaid. Aptly the documentation of the injuries sustained needs to be stressed upon simultaneously, as majority of them are grievous.

A patient who sustains bear mauling should be rushed to the nearest primary medical center. At the primary center, the patient should be administered tetanus toxoid vaccination as per usual norms for animal bite patients. Exploration, debridement and loose tucking of the wounds should be done, and the injuries should be recorded. The patients should then be immediately referred to an advanced center for reconstructive surgery. After bear mauling, the delay in receiving definitive treatment at tertiary care center that happens due to distance and transport problems proves significant in terms of morbidity and mortality.

At the advanced center, the high-risk area i.e. upper and mid face should be given attention. The recording should be in pictures and text. An action plan in coordination with the concerned specialties should be drawn and priorities established. Top priority should be given to the injured eye. Enucleation of a perforated eye should be done to prevent sympathetic ophthalmitis. Emergency tracheostomy is a lifesaving procedure and should be carried out when needed. The fractured facial bones should be stabilized by mini plate screws or inter-osseous wires. Large raw areas created after generous debridement of the injured soft tissue should be given coverage in the form of spilt thickness skin grafting or a flap. This leads to early uneventful healing and acceptable cosmesis. Residual deformities can be managed at a later stage. Also, a proper follow up of patients with counseling regarding management of PTSD should be taken into consideration. As said earlier; man, versus bear- a battle yet to be ended.

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Institutional Ethics Committee

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