

Bite injuries at Bugando Medical Centre, Mwanza, Tanzania: A five year experience

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Background: Bite injuries constitute a continuing challenge to trauma or general surgeons practicing in developing countries. Little work has been done on bite injuries in our setting. This study describes our experience in the management of bite injuries, outlining the etiological spectrum, injury patterns and results of management of bite injuries in our setting.

Methods: A 5-year retrospective study of patients who were attended after sustained bite injury was conducted at Bugando medical Centre between October 2005 and September 2009. Data were collected from patients' records and operation theatre registers and analyzed using SPSS software version 11.5. Research Ethics committee approval was sought before the study was commenced.

Results: A total of 98 bite injury patients were recruited in the study. Males were 55 (56.1%) and females were 43 (43.9%). Majority of patients were in the age group of 21-30 years old. Human bites (58.2%) were the most common type of injury. Most injuries occurred in the upper limbs (29.6%). Bruises (41.8%) and punctured wounds (33.9%) were the most type of wounds sustained. Majority of patients (59.2%) were treated conservatively and the remaining patients (40.8%) underwent operative procedures. Wound infection was the most common complication and majority of patients had polymicrobial bacterial profile. *Staphylococcus aureus* was the most common organism isolated. Majority of patients had no permanent disability. The mean length of hospital stay was 7 days. Mortality rate was 0.8%.

Conclusion: Bite injuries, though rare in our setting, are a unique form of trauma that is associated with high complication rates such as wound infections, tetanus, rabies, HIV transmission and limb amputations. Measures towards prevention and proper treatment are important in order to reduce morbidity and mortality resulting from this form of trauma. Similar study is recommended in a prospective setting to properly assess the magnitude of the problem.

Introduction

Bite injuries are a unique form of trauma that constitute significantly to high morbidity and mortality both in developing and developed countries¹. Many victims with minor injuries from bite injuries do not present for treatment, so the actual worldwide incidence is unknown².

In the US, approximately 1 to 2 million people sustains bite injuries each year, human bites being the third most common following those of dogs and cats. More than 50% of these victims are infant and preschool children^{2,3}. A study in the United Kingdom found that human bite injuries accounted for 13% of all bite injuries and majority of victims were males aged 16-25 years⁴. Studies conducted in Zimbabwe and Nigeria showed that majority of bite injury victims were females aged between twenty and thirty nine years^{5,6}. This is in disagreement with results from Ghana where more males than females were involved⁷. A study of human bites in Kenya found equal sex distribution between assailants and the victims⁸.

Bite injuries poses a therapeutic challenge in trauma surgery because of their high complication rates compared to similar soft tissue wounds caused by other reasons^{9,10}. Because of the large number of bacteria in the oral cavity, bite wounds are generally considered dirty or contaminated, and their treatment is difficult because of the risk of infection, especially in extensive injuries¹¹. Most infections caused by mammalian bites are polymicrobial, with mixed aerobic and anaerobic species¹².

Transmission of human immunodeficiency virus (HIV) has also been reported in literature as a result of a human bite wound¹³. Bite injuries by large wild and aquatic animals are a common cause of limb amputations and may be associated with rabies and tetanus¹⁴.

Local studies that determine the magnitude, causes, injury patterns and prognosis are prerequisite for planning preventive measures and management protocols of this form of trauma^{9,12}. Very little is known about bite injuries in our setting as there is no local study which has been done. This study was conducted to identify the etiological spectrum, injury pattern, treatment modalities and outcome of bite injuries in our local setting. The study provides basis for planning preventive measures and management protocols of these patients in our environment setting.

Patients and Methods

This was a retrospective cross sectional study of bite injury patients seen at Bugando Medical Centre over a five-year period between October 2005 and September 2009. Bugando Medical Centre is a consultant, teaching and referral hospital serving six regions (Mwanza, Mara, Kagera, Shinyanga, Kigoma and Tabora) around the Lake Victoria. It has a bed capacity of 1000. The study population included all bite injury patients of all age group and gender. Data were collected from patients' records and operation theatre registers. The records were reviewed for demographic information, types and pattern of injuries, treatment modalities, management complications, length of hospital stay and mortality. Patients with incomplete data were excluded from the study. The approval to carry out the study was sought from relevant authorities. Data were entered into the computer and analyzed using SPSS software version 11.5. Significance was defined as a p-value of less than 0.05.

Results

A total number of 98 bite injury patients were studied. Of these, 55 (56.1%) were males and 43 (43.9%) were females (M: F ratio = 1.3:1). The patients' ages ranged from 4 to 62 years with a mean of 29 years and a peak age incidence of 21-30 years (Table 1). Human bites were the most common type of injury and accounted for 58.2% (Table). Most injuries were in the limbs (56.1%) with the upper limbs dominating (29.6%) compared to the lower limbs (26.5%). Head and neck were the most common injuries due to human bites and accounted for 42.1% of all human bites. These commonly involved the maxillofacial region. The lower limb was commonly affected in other types of injuries (Table 2). Bruises and punctured wounds were the most common type of bite injury wounds accounting for 41.9% and 33.9% respectively. Amputations (1.8%) were the least common and were due to crocodile bite (Table 3).

Table 1. Age Distribution

<i>Age group</i>	<i>Frequency</i>	<i>Percent</i>
0-10	12	12.2
11-20	15	15.3
21-30	24	24.5
31-40	18	18.4
41-50	14	14.3
51-60	10	10.2
> 60	5	5.1
Total	98	100

Table 2. Distribution of the type of injury by site

Type/site of injury	Head/neck	Trunk	Upper limb	Lower limb	Genitalia	Total
Human bite	24 (42.1%)	10(17.5%)	20 (35.2%)	2 (3.5%)	1 (1.7%)	57(58.2%)
Domestic Animals (Dogs and Cats)	1 (5.9%)	2 (11.8%)	5 (29.4%)	9 (52.9%)	-	17(17.3%)
Snake bite	-	2 (15.4%)	2 (15.4%)	9 (69.2%)	-	13(13.3%)
Aquatic animals (Crocodiles)	-	1 (14.2%)	1 (14.2%)	4 (57.1%)	1(14.2%)	7(7.1%)
Wild animals (Hyena)	-	1 (25.0%)	1 (25.0%)	2 (50.0%)	-	4(4.1%)
Total	25 (25.5%)	16 (16.3%)	29 (29.6%)	26 (26.3%)	2 (2.0%)	98 (100%)

Table 3. Types of bite wound

Type of bite wound	Frequency	Percent
Bruises	47	41.9
Punctured wounds	38	33.9
Avulsion	21	18.8
Crush wounds	4	3.6
Amputation	2	1.8
Total	98	100

Table 4. Complications

Complication	Frequency	Percent
No complication	52	53.1
Wound infection	38	28.6
Permanent deformity	13	13.3
Loss of limb (amputation)	3	3.0
Tetanus	2	2.0

Majority of patients 82 (83.6%) presented within 24 hours of their injuries. 57 patients (58.1%) were managed and discharged home. The remaining patients were admitted for 2 days or longer. All patients were administered antibiotics of varying nature at the Accident and Emergency department. Analgesics (parenterally or orally) were also given to all patients. Ninety six (97.9%) patients received tetanus toxoid and sixteen (16.3%) patients received antirabies. Blood transfusion was given to 6 patients (6.1%). Fifty eight patients (59.2%) were treated conservatively with cleaning of wounds with normal saline and apply dressing.

Forty patients (40.8%) underwent operative procedures mainly debridement and primary or delayed primary closure. 69.7% of these were under general anesthesia, the remainder under

local or spinal anesthesia. A smaller number had primary or delayed plastic reconstruction such as a local flap or grafting. The majority of patients (80.0%) requiring operative procedures underwent surgery within 24hours.

Table 5. Type of pathogens isolated

Type of pathogens	Frequency	Percent
Staphylococcus aureus	8	34.8
β-Haemolytic streptococcus	5	21.7
Staphylococcus epidermidis	4	17.4
Streptococcus faecalis	2	8.7
Pseudomonas spp	2	8.7
Proteus spp	1	4.3
Campylobacter spp	1	4.3
Total	23	100

Forty patients (40.8%) underwent operative procedures mainly debridement and primary or delayed primary closure. 69.7% of these were under general anesthesia, the remainder under local or spinal anesthesia. A smaller number had primary or delayed plastic reconstruction such as a local flap or grafting. The majority of patients (80.0%) requiring operative procedures underwent surgery within 24hours.

Most patients (53.1%) had no complications (Table 4). The complication rate was 46.9%. Wound infection (28.6%) was the most common complication and majority of patients had polymicrobial bacterial profile. Only 28 pus swab cultures from patients with septic wounds were available for analysis; of these, 23 cultures (82.1%) had pathogens isolated. *Staphylococcus aureus* was the most common organism isolated (Table 5). Patients with wound infection was found to have a longer interval between injury and presentation, which was statistically significant ($p < 0.001$) when compared to patients without wound infection. The mean length of hospital stay was 8 days. Eight patients (0.8%) in this study died. Wound infection was found to be significantly related to the length of hospital stay and mortality (p -value < 0.05).

Discussion

Bite injuries present a worldwide therapeutic challenge in traumatology because of their high complication rates compared to similar soft tissue wounds caused by other reason^{9, 10}. This study was conducted to describe our experience in the management of this form of trauma, outlining the etiological spectrum, injury pattern, treatment modalities and outcome of bite injuries, a problem not previously studied in our setting.

Majority of our patients in the present study were young adult males between the ages of 21 and 30 years the very productive period of life. Similar age and gender distribution was also reported by other studies^{4,7}. The male preponderance in our study is in contrast to other studies which reported female preponderance^{5,6}. A study in Kenya found equal sex distribution⁸. The reason for this gender difference may be because males generally are at higher risk than females for bite wounds due to their typically more aggressive nature.

Human bite injuries were the most common type of injury in our study. This finding is not in agreement with the report from one study in which human bites were the third most common after those of dogs and cats³. Human bites usually occur in situations where there is violence such as fights and assaults⁸. It has been shown that there is an overwhelming association between alcohol intake and human bite injuries, and they occur predominantly at the weekend. Alcohol plays a major role in violent crime and public disorder. It has been shown that alcohol is associated with violent crime at a higher level than non-violent crime. Most incidents involve drinking by the offender, the victim, or both^{15,16}. Human bite injuries can also occur unintentionally in other situations like in sexual activities⁸. Interestingly, in our study we had one patient who sustained breast and nipple bite injury during sexual climax. In this case, the male partner was bitten by the female partner. Increased incidence of human bites in this study can be due to increased rate of crime in Mwanza city. BMC being situated around Lake Victoria, one would expect large number of bite injuries resulting from aquatic animals like crocodile. The low rate of bite injuries from aquatic animals in our study can be explained by the fact that the majority of these injuries die before reaching the Accident and Emergency department. These animals can produce severe injuries by grasping victims with their powerful jaws and dragging them underwater, where they roll while crushing their prey¹⁴.

The upper limbs, as organs of prehension being involved in attack and defense are the commonest injured. In this study, the upper limb was commonly affected followed by lower limbs and head and neck. The distribution of the type of injury by site revealed that the head and neck were the most common injuries due to human bites and commonly involved the maxillofacial region. Eardley et al¹⁶ reported similar injury pattern of human bite. Human bites in the maxillofacial region usually compromise function and aesthetics, resulting in social and psychological effects. The most prominent parts of the maxillofacial region such as the lip, nose and the ear are usually at risk^{8,16}. In our study, the lip was commonly affected followed by the cheek and the ears. These findings are in agreement with previous studies in Kenya and Nigeria^{6,8}. This could be explained by the position of the lower lip in the face, which makes it among the most prominent parts in the face and therefore easy to be grabbed by the attacker's teeth. Bite injuries in unusual sites have also been reported in literature^{8,17}.

We found two cases of penile bite injuries due to hyena and human bite respectively. Gilyoma⁸ in Kenya reported an unusual trauma of the glans penis secondary to human bite. This form of trauma usually occurs in people with aberrant sexual behaviour or as a result of animal bites^{8,17}.

The type of wounds in bite injuries vary with the force of biting applied by the attacker and the species^{8,12}. The wound can range from minor bruises to more extensive injuries like punctured wounds, avulsions, amputations and separation of a pedunculated flap^{8,12,14}. Humans attacked by large animals for example are at risk for blunt and penetrating trauma. Animals produce blunt injuries by striking with their extremities, biting with their powerful jaws, and crushing with their body weight. Teeth and claws can puncture body cavities, including the cranium, and amputate extremities¹⁴. In our study, bruises and punctured wounds were the most common type of bite injury wounds encountered. Limb amputation occurred only in two patients due to crocodile bite. Similar finding was reported in other studies^{9,12}. Human bites usually cause bruises and punctured wounds³. This is reflected in the high rate of minor injury wounds in our patients, majority of whom had human bite.

Patients presenting with bite injuries can be grouped into two distinct groups. The first group present early, less than 12 hours after a bite, because of concern about infection of the wound or disfigurement as a consequence of the injury. These patients predominantly have a contaminated wound with no signs of infection. The second group presents more than 12 hours after the injury. They usually have signs of a developing infection such as fever, purulent wound discharge, pain and local adenopathy¹². Late presentation is usually associated with increased rate of complications. The majority of our patients presented early within 24 hours of their injuries. This finding is in agreement with other studies^{8,16}. Early presentation in our study reflects the low complication rate in these patients.

The management of bite injuries usually takes into account the type of animal that has inflicted the bite, any patient risk factors for infection, local and systemic signs of infection, and the patient's vaccination status¹². Local wound management reduces the risk for infection and maximizes functional and aesthetic outcomes. Early wound cleansing is the most important therapy for preventing infection and zoonotic diseases such as rabies¹⁴. The principles of management of bite injuries include cleaning and debriding the wound, consideration of prophylactic antibiotics, treatment of infectious complications when they develop and appropriate use of tetanus vaccination^{12,14}. Minor bite wounds are usually treated conservatively with prophylactic antibiotics, analgesics, tetanus toxoid and cleaning of wounds with normal saline and apply dressing.

Extensive bite wounds require operative procedures mainly debridement and primary or delayed primary closure¹⁴. Options for wound repair include primary, delayed primary and secondary closure. The anatomic location of the bite, the source of the bite, and the type of injury determine the most appropriate method. Primary closure is appropriate for most bites to optimize the aesthetic and functional outcome, especially head and neck wounds that are initially seen within 24 hours of the bite and for which aesthetic results are important and infection rates are low. Primary closure can also be used for low-risk wounds to the arms, legs, and trunk if seen within 6 to 12 hours of the bite^{7,18,19}. Severe bites and avulsion injuries of the face that require flaps have been successfully repaired by primary closure; however, this technique remains controversial⁷. Wounds prone to the development of infection, such as those initially seen longer than 24 hours after the bite (or longer than 6 hours if ear or nose cartilage is involved), are covered with moist dressings and undergo delayed primary closure after 3 to 5 days¹⁹.

Puncture wounds have an increased incidence of infection and are not sutured. Deep irrigation of small puncture wounds and wide excision has not proved beneficial. Larger puncture wounds, however, usually benefit from irrigation and debridement. Healing by secondary intention generally produces unacceptable scars in cosmetic areas^{12,18,19}. In this study the majority of patients were treated conservatively and only few patients underwent surgical procedures. This finding is in keeping with other studies which reported similar management trend^{8,16}. This observation can be explained by the fact that the majority of our patients had minor bite wounds requiring only conservative treatment.

Because of the large number of bacteria in the oral cavity, bite wounds are generally contaminated, and their treatment is difficult because of the risk of infection, especially in extensive injuries¹¹. Most infections caused by bites are polymicrobial, with mixed aerobic and anaerobic species¹². The bacteria associated with bite infections may come from the environment, from the victim's skin flora, or most frequently, from the 'normal' oral flora of

the biter^{8,12}. In this study, wound infection was the most common complication and majority of patients had polymicrobial bacterial profile. Staphylococcus aureus was the most common organism isolated. Similar observation was also noted in other studies^{8,16}. In our study, delayed presentation was the most significant predictor of wound infection. It has been noted that the median time to presentation with the first symptoms of infection is 24 hours. Factors that increase the risk of infection include delayed presentation, deeper wounds, puncture injuries, crush wounds and wounds on the hand¹².

We also noted with concern that wound infections were common in limb injuries compared with similar bite wounds of the head and neck. This finding is in agreement with what has previously been reported from studies done elsewhere²⁰⁻²². These early studies established the anatomical basis for differing infection rates between facial and limb injuries. It was demonstrated that limb wounds carried a higher risk of becoming clinically infected compared with similar bite wounds of the head and neck, with the differing vascularity of the regions proposed as accounting for this difference.

With the advent of HIV and Hepatitis B as complications of skin breaching injury, transmission of infectious diseases like HIV and Hepatitis B has been reported in literature as a result of a human bite wound¹³. We had no documented evidence in our study regarding transmission of the viruses by human bite injuries. However, despite lack of this documentation in our study, the risk of transmission is still apparent. We therefore recommend that every patient presenting with human bite injury should be checked for HIV and Hepatitis B virus status. This has profound medico-legal consequences.

Conclusion

Bite injuries, though rare in our setting, are a unique form of trauma that is associated with high complication rates such as wound infections, tetanus and limb amputations. Human bite injury is a common problem in our setting and tends to affect young males with a peak in the third decade, the very productive period of life. The risk of HIV and Hepatitis B virus transmission is high as a result of human bite. Measures towards prevention and proper treatment are important in order to reduce morbidity and mortality resulting from this form of trauma. Every patient presenting with human bite injury should be checked for HIV and Hepatitis B virus status for medico-legal and post-exposure prophylaxis purposes. Similar study in a prospective setting is recommended to properly assess the magnitude of the problem.

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