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REVIEW ARTICLE

SURGICAL MANAGEMENT OF ANIMAL AND HUMAN MAXILLOFACIAL BITES: A COMPREHENSIVE REVIEW

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Abstract

Objectives: Animal and human bites to the face occurs commonly. If they are not fatal, these injuries can lead to highly detrimental effects. The aim of this paper is to review literature on this topic and to update knowledge on the subject.

Methods: A comprehensive review by PubMed, Web of Science and Google Scholar was performed using the terms “face bite” and “face attack” for surgical management of wounds. No language restrictions or animal species were applied. Articles from the last 42 years have been included.

Results: A total of 71 articles from 29 different countries worldwide were included. Despite animals’ anatomy and geographic differences, multiple steps of surgical management are essential to prevent wound infection, in addition to unaesthetic and functional issues. Late attendance can be very harmful.

Conclusions: Besides several important steps, copious lavage with saline and later with an antiseptic is considered the be the most effective surgical maneuver. Primary suture and later reconstruction considerations were listed. Tetanus and rabies must be screened. If in doubt, prophylaxis is strongly recommended.

Keywords: *Bites and Stings; Bites, Human; Maxillofacial Injuries; Animals Domestic; Animals, Wild; Wounds and Injuries.*

Introduction

Animal attacks are not a modern question. Perhaps the most famous fatal case of animal attack is King Alexander of Greece, who died of an infected wound resulting from a monkey bite on his lower limbs. Approximately 1% of all emergency

departments involve animal or human bites[1,2] with published reports of animal injuries to the maxillofacial area dating back to the 19th century.[3] A significant number of these attacks affects the maxillofacial region.[4]

A wide variety of animals may be involved, from domestic to wild animals. Mammals, marine animals, insects, birds and humans. Animal bites, claws and stings have been reported have been reported in most animal groups worldwide. Even domesticated animals that are considered docile and peaceful can be involved in fatal accidents when the maxillofacial region is injured.[5] Human bites are amongst the most common. In some countries is considered the more usual.[6]

The focus of articles on this topic is antibiotic prophylaxis, which prevents any wound infection.[7,8]

Surgical management of these injuries is not discussed to the same extent, although it is considered as a major public health problem worldwide.[9,10] Despite the incidence and pattern of maxillofacial injuries from animal attacks varies widely around the world, are there specific steps in surgically treating these wounds to achieve a better outcome?

The aim of this study is therefore to provide a comprehensive review of more than 40 years on this topic. The authors evaluated specific steps that could assist maxillofacial surgeons in the surgical management of maxillofacial injuries from animal attacks, regardless of animal species. Some epidemiological aspects were also discussed.

Material and methods

The data in this article were derived from an extensive literature review. The articles were selected from the PubMed, Web of Science (WS) and Google Scholar (GS) databases. No language restriction was applied, surgical management of maxillofacial bites in any language was considered. Articles focusing on antibiotic prophylaxis and non-maxillofacial attacks were excluded, as were reviews and case reports with outdated knowledge of the topic.

The search covered the period from the beginning of the database to April 17, 2022. Articles published from 1980 to the founding were included. The search terms were “face bite” and “face attack”. The titles and summaries of the records found in the main loft have been read. The full texts of the data sets selected after this phase were assessed and relevant data was extracted by the authors.

The authors intended to answer the following focused question: Is there any update knowledge on the surgical management of facial bites?

Results

After removing duplicates and off-topic articles, a total of 71 articles were retrieved from PubMed, WS, and GS on the surgical management of maxillofacial injuries due to animal or human bites, along with cross-referencing. Two articles were published in German language,[11,12] two in French[13,14] and the rest in English (94.36%).

About 61% (44) of the included articles were case reports or case series and one article was a survey.[15] Seven articles were prospective studies[2,9,16–20] and 19 retrospective studies.[4,11,12,14,21–35] Three of these articles relate to surgical humanitarian reconstruction missions due to animal attacks on the maxillofacial region.[36–38] All of these three articles are studies conducted on the African continent. The items included are from every inhabited continent except Central America. Thirteen studies were from Africa,[13,17,19,20,22,23,36–42] 17 from Asia,[32,33,43–57] 17 from Europe [2,7,11,12,14,15,24,27,28,34,35,58–63], 14 from North America,[4,10,16,18,25,30,31,64–70] five from Oceania [6,21,26,29,71], and five from South America.[9,72–75]

Dog bites are the most commons animal attacks on the face and this can be seen in this study as 29 included articles are associated only with dogs and one with dogs and cats.[25] Some studies referred to studies with general animals,[21,28,34] while some were more specific to mammalians[11,16,22,29] (including dogs and cats), wild mammals,[40] and wild animals.[41] Ten articles reported treatment of human facial bites,[6,15,17,19–21,23,37,39,62] six of them from Africa.[17,19,20,23,37,39]

Less common, peculiar animal bites were also reported, including bears,[56] camels,[45,49,51] crocodiles,[42] hyenas,[36,38] leopards,[50,53,68] rats[63] and wolves.[43,48] Venomous animal bites are more associated with lower limb bites, but some reports of facial bites have been included, notably scorpions[33,52] and snakes.[46,55,57,58] Despite fewer in number, maxillofacial stings have been associated with bees[13] and insects.[59] Even marine animals have been

implicated in these injuries, notably two jellyfish envenomation reports.[44,71]

Discussion

Children, especially younger children, are more susceptible to facial animal attacks[2,4,9,25,54] because of their short stature and constant sudden movements.[9,18,21,30,65] Adults are vulnerable to upper limbs attacks.[35] The vast majority of maxillofacial injuries are related to dog bites followed by cats.[4,9,21,34,38,68] Most dog bites were on the face.[14,18,24,26,31,32] Some articles refer to family dogs, others to stranger dogs, with no consensus, except during COVID-19 pandemic when family dogs have a higher rate of bites.[24]

The number of pets bites have increased during the COVID-19 pandemic because of stay-at-home orders.[10,24] Studies suggest that the number of pets bites has tripled as a result.[10] Human bites usually occur on the lips, ears, nose and cheeks.[15,19,20,39] Most are related to personal violence and sexual intercourse[17,19] and are more likely to become infected due to oral microflora than other animals such as dogs.[16] A slight predominance between male patients for dog bites and female for cat bites was found in some articles,[18,21,32] but there is no clear trend regarding genders and facial bites.

Some animal bites such as by large mammals and large carnivores usually occurs in the head and neck area, intentionally more lethal to the victim,[41,68] and very often involves crushing and amputation.[36,38,42,43,50,51,53,56]

Fatal bites are related to food and not territorial defense.[42] Human flesh pleases the palate and is considered part of the diet of a few wild animals.[36,38] Although most wildlife attacks are associated with residents of rural areas,[36] tourists in wild regions are also affected.[40] These wildlife attacks are more prone to be much more traumatic than pet bites, particularly due to the significantly higher bite force.[38,53] The management of fractures of the maxillofacial bones is not different from other etiologies. The major concern of maxillofacial surgeons is soft tissue lesions, not only because of the primary closure and possible reconstruction, but also because of the short- and long-term occurrence of infections.

Venomous animal bites can cause a number of complications. Envenomation must be treated with specific anti-venom therapy[46,57] but there are some polyvalent venoms if the snake cannot be identified. In some cases of facial snakebite, nasotracheal intubation may be required.[46] Fang fragments and stings must be sought and removed because of the risk of contamination.[13,55,57–59] Imaginological studies could help surgeons in their search for these fragments.[58] Scorpion stings are not fatal in most cases but are very painful. The facial anesthesia block is useful for reducing pain. Infiltrative anesthesia must be avoided as scorpion toxins compete with local anesthetics.[52] Younger children have a poorer prognosis due to low body weight and serious complications.[33] A recent trend is the development of rapid diagnostic kits, in order to identify animal species and develop antivenoms as early as possible.[55] Cardiac examination and blood pressure as well as monitoring of airway permeability are essential in cases of envenomation.[44,71]

Some articles have proposed a classification of maxillofacial injuries[2,14,19] but Lackmann´s classification (Table 1)[76] has been used most frequently in articles to describe this type of injury.[28,34,54] A description of maxillofacial injuries such as puncture, laceration and abrasion were found in most articles. Puncture wounds are more susceptible to infection than large lacerations.[11,15,16,29,34,51,53,68]

This explains why cat bites are more infected than dog bites. About one-fifth to one-third of animal bites are infected through claws and teeth.[30,32,56,65] Despite older authors recommend avoiding suturing, contemporary authors suggest that primary wound closure yields good results and a low incidence of infection due to the rich blood supply of the face.[4,9,14,15,18,27,28,35,50,51,53,56,67,68,70,74,75]

Main reason why antibiotic prophylaxis is not mandatory for all maxillofacial bite injuries. Ensuring an adequate blood supply to soft tissues is the cornerstone of preventing necrosis and reducing wound infection.[54,70] The central region must be handled first because of a more complicated surgical management.[7,14,47,54,66] Facial wounds that are not sutured can result in severe unaesthetic and functional damage.[9,18,35,41,51,54,70,72] Spaces between stitches on the skin can be useful to enable for spontaneous drainage,[72] a suitable option for scar reduction. Most surgeons suggest delayed primary

closure without infection, reducing the rate of infection, or using a dressing.[30,41,45,53,56] For wounds with more than 24 hours of primary care, no consensus was found on suturing,[15,56] nor for multiple layers of soft tissue suturing.[30,72] An antibiotic dressing is recommended by a few authors,[30] while hydrocolloid-based compression bandages and kinesiotherapy are suitable options.[14] Laser therapy is considered very useful in several cases.[14,65,69]

In the event of tissue avulsion, replantation must be considered as the first option.[7,15,23,64,66,70,74] Not only aesthetic complaints but also functional problems are very often encountered.[73] When cartilages such as nose and ear are affected, another cartilage can serve to allow further reconstruction.[43,61,69] Free grafts must not exceed 1cm to avoid compromising vascularization.[73] Immediate flaps and microvascular anastomosis are successful methods to prevent further necrosis.[64,70,73] More successful outcomes are associated with arterial and venous anastomosis.[7,43,64,66]

Reconstructive flaps, scar revision and grafts may be required in a significant number of cases.[6,7,9,12,14,18,23,36–38,43,47,54,63,73,75]

Depending on the extent of the wound, a tissue expander might be a suitable alternative.[43] Hyperbaric oxygen therapy is considered a safe and effective protocol to prevent tissue necrosis.[70] Leech therapy for about a week is another very helpful alternative to prevent tissues damage after reconstruction, replantation or reapproximation closure.[7,60,64,66,70] Blood loss, anemia and infection should be monitored once leech therapy is stablished.[7,64,70]

Sialocele and salivary fistulas are commons complications of injuries to the parotid region. The same applies to canalicular injuries in trauma in the eyelid area. Some authors recommend early surgical repair of all ductal and facial nerve injuries[67,74] in addition to conservative treatment of salivary fistulas such as transdermal scopolamine and pressure bandages.[49]

Incidence of infections is higher in delayed treated patients.[6,11,14,28–30,37,56,68,74] No consensus on the optimal time for first attendance, but 24 hours was considered a key time. Before suturing, bite wounds must be flushed abundantly with saline, about 250ml, with pressure.[15,20,37,39,43,51,53,56,67,74,75] Considered by several authors to be the keystone of the surgical management of animal and human bites to the face. Irrigation for at least 15 minutes is recommended.[30] In addition to saline, the authors use various antiseptic solutions to irrigate the region, including hydrogen peroxide,[42,45,56] sodium hypochlorite,[15,42] povidone-iodine solution,[41,45,48,50,53,67,75] and chlorhexidine.[30,50,59]

Careful debridement of the bruised and devitalized tissues is crucial.[15,23,30,34,39,43,45,51,53,68,70,74,75] Proteolytic agents can be used for this purpose, also for the treatment of contaminated wounds.[50] In the case of deep sutures, the use of a drain for about 48 hours is recommended.[42]

Any patient who has suffered an animal or human attack must have a history of tetanus vaccine. Animal bites, particularly wild and unknown ones, are highly suspected to be associated with tetanus and rabies.[32,37,47,48,50,53,62,74] Tetanus toxoid 0.5ml and tetanus antitoxin 250 IU must be implemented in case of doubt.[42,45,46,50] The same applies for rabies prophylaxis[27,45,48,50,75] especially in the case of cats, dogs and wild animal bites.[22,41,53] Contrary to the view of some authors that antibiotic prophylaxis is less necessary for facial bites, rabies prophylaxis is more urgent due to the proximity to the central nervous system.[22,27] Some authors recommend application of rabies immunoglobulin to the wound edges.[48] Several other infectious diseases can be transmitted through bites such as Ebola, herpes, monkeypox, yellow fever, hepatitis B, HIV, and tuberculosis.[15,41]

Post-traumatic stress is very usual,[54] which becomes very important for a psychiatry consultant to avoid mental and emotional disorders.[2,14,31,50] Counseling with a dedicated maxillofacial surgeon is suitable to reconcile patient and family outcome expectations.[18,74]

Conclusions

Although each animal or human bite in the maxillofacial region requires individual treatment, several steps are basilar to achieve a successful aesthetic and functional outcomes. According to the literature, extensive rinsing with saline solution and later an antiseptic solution is mandatory. Although no consensus was reached, iodine-povidine was used for most authors. Primary suture and early management

are paramount to successful outcomes. Tetanus and rabies prophylaxis as so psychological counselling should be on the list of items to be checked.

Declaration

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Competing interests

Authors declare that they have no conflicts of interest to disclose.

Ethical approval

Not applicable.

Authors contribution

All authors contributed equally to this manuscript. All authors read and approved the final manuscript.

Table 1. *Lackmann´s classification*

I	Superficial injury without muscle involvement
IIA	Deep injury with muscle involvement
IIB	Full-thickness injury of the cheek or lip with oral mucosal involvement
IIIA	Deep injury with tissue defect (avulsion)
IIIB	Deep avulsive injury exposing nasal or articular cartilage
IVA	Deep injury with severed facial nerve and/or parotid duct
IVB	Deep injury with concomitant bone fracture

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ԿԵՆԴԱՆԻՆԵՐԻ և ՄԱՐԴԿԱՆՑ ԴԻՄԱԾՆՈՏԱՅԻՆ ԿԾԱԾ ՎԵՐՔԵՐԻ ՎԻՐԱԲՈՒԺԱԿԱՆ ԿԱՌԱՎԱՐՈՒՄ. ՀԱՄԱՊԱՐՓԱԿ ԱԿՆԱՐԿ

Ռիկարդո Գրիլո MSc,[1,2,3] Ալեքսանդր Մեյրելես Բորբա,[4,5] Մարիանա Բրոզոսկի,[1]
Սանդրո Բորնելլի Մորեյրա,[1] Յուրի Սլյուսարենկո դա Սիլվա,[6] Մարիա դա Գրակա Նակլերիո-Օմեմ[1]

1. Բերանի և դիմածնոտային վիրաբուժության, վնասվածքաբանության և պրոթեզավորման ամբիոն, Սան Պաուլոյի համալսարանի ստոմատոլոգիայի ֆակուլտետ, Սան Պաուլո, Բրազիլիա
2. Բերանի և դիմածնոտային վիրաբուժության բաժանմունք, Պատոս դե Մինասի ֆակուլտետ, Բրազիլիա
3. Բերանի և դիմածնոտային վիրաբուժության բաժանմունք, Սան Լեոպոլդո Մանդիչի ֆակուլտետ, Կամպինաս, Բրազիլիա
4. Բերանի և դիմածնոտային վիրաբուժության բաժանմունք, Կույաբայի ընդհանուր հիվանդանոց, Մատո

Գրոսսո, Բրազիլիա
5. Համալրված ստոմատոլոգիական գիտությունների հետազոտական ծրագիր, Կույաբայի համալսարանի ստոմատոլոգիայի ֆակուլտետ – UNIC, Կույաբա, Մատո Գրոսսո, Բրազիլիա
6. Ստոմատոլոգիայի դպրոց – UniFG համալսարանական կենտրոն, (Գուանամբիի ֆակուլտետ), Բահիա, Բրազիլիա

Ամփոփում

Նպատակ. Կենդանիների և մարդկանց կծած վերքերը դեմքին տարածված են: Եթե դրանք մահացու չեն, ապա այդ վնասվածքները կարող են հանգեցնել խիստ վնասակար հետևանքների: Այս հոդվածի նպատակն է վերանայել այս թեմայի վերաբերյալ գրականությունը և թարմացնել այդ թեմայի վերաբերյալ գիտելիքները:

Մեթոդներ. PubMed-ի, Web of Science-ի և Google Scholar-ի կողմից իրականացվել է համապարփակ ակնարկ՝ օգտագործելով «դեմքի կծած վերքերը» և «դեմքի վրա հարձակում» տերմինները վերքերի վիրահատական բուժման համար: Լեզվի սահմանափակումներ կամ կենդանիների տեսակներ չեն կիրառվել: Ներառվել են վերջին 42 տարվա հոդվածներ:

Արդյունքներ. Ընդամենը ներառվել են 71 հոդվածներ աշխարհի 29 տարբեր երկրներից: Չնայած կենդանիների անատոմիային և աշխարհագրական տարբերություններին, վիրաբուժական կառավարման բազմաթիվ քայլերը կարևոր են վերքի վարակը կանխելու համար, բացի ոչ էսթետիկ և ֆունկցիոնալ խնդիրներից: Ուշ հաճախելը կարող է շատ վնասակար լինել:

Եզրակացություններ. Մի քանի կարևոր քայլերից բացի, առատ լվացումը ֆիզիոլոգիական լուծույթով, իսկ հետագայում հակասեպտիկով համարվում է ամենաարդյունավետ վիրաբուժական մանևրը: Թվարկվեցին կարի առաջնային և հետագայում վերակառուցման նկատառումները: Տետանուսը և կատաղությունը պետք է հետազոտվեն: Եթե կասկածներ կան, ապա կանխարգելումը խստորեն խորհուրդ է տրվում:

ХИРУРГИЧЕСКОЕ ЛЕЧЕНИЕ ЧЕЛЮСТНО-ЛИЦЕВЫХ УКУСОВ ЖИВОТНЫХ И ЧЕЛОВЕКА. ВСЕСТОРОННИЙ ОБЗОР

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1. Кафедра челюстно-лицевой хирургии, травматологии и протезирования – факультет стоматологии Университета Сан-Паулу, Бразилия.
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5. Программа исследований по интегрированным стоматологическим наукам, факультет стоматологии Университета Куябы – UNIC, Куяба, Мату-Гросу, Бразилия
6. Школа стоматологии – Университетский центр UniFG (факультет Гуанамби), Баия, Бразилия

Абстракт

Цель: Укусы животных и человека в лицо встречаются часто. Если они не смертельны, эти травмы могут привести к весьма пагубным последствиям. Целью данной статьи является обзор литературы по этой теме и обновление знаний по этому вопросу.

Методы: Всесторонний обзор, проведенный PubMed, Web of Science и Google Scholar, был проведен с использованием терминов «укус лица» и «атака в лицо» для хирургического лечения ран. Никаких языковых ограничений или видов животных не применялось. Включены статьи за последние 42 года.

Результаты: Всего в него была включена 71 статья из 29 разных стран мира. Несмотря на анатомию животных и географические различия, для предотвращения раневой инфекции, помимо неэстетичных и функциональных проблем, необходимы многочисленные этапы хирургического лечения. Позднее посещение может быть очень вредным.

Выводы: Помимо нескольких важных шагов, наиболее эффективным хирургическим приемом считается обильное промывание физиологическим раствором, а затем антисептиком. Были перечислены вопросы первичного наложения швов и последующей реконструкции. Необходимо пройти обследование на столбняк и бешенство. В случае сомнений настоятельно рекомендуется провести профилактику.