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Case Report

Skin graft on a collagen and elastin matrix fixed with negative pressure in a complicated pediatric dog bite: case report

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ABSTRACT

Animal bites represent a significant source of morbidity in the pediatric population, with dogs being the primary cause. Highlighting the need for innovative solutions to effectively tackle the issue and enhance both functional and aesthetic outcomes. Dog bites, marked by a heightened morbidity rate, present an inherent infection risk owing to the considerable bacterial load present in saliva. The fundamental approach to treatment revolves around preventing infection through meticulous washing, debridement, and the timely implementation of early primary closure. We detail the management of a pediatric patient with a dog bite on the pelvic limb, resulting in a challenging-to-manage wound. This case was successfully treated with a skin graft on a bed of collagen matrix, secured with negative pressure therapy. The choice of the appropriate technique for reconstructing skin defects depends on their depth and size. Consequently, combining these three techniques yielded a favorable functional and aesthetic outcome for the patient. This case report emphasizes the relevance of employing different techniques in managing complicated dog bites.

Keywords: Skin graft, Dermal matrix, Negative pressure device, Dog bite

INTRODUCTION

Animal bites, particularly those from domestic dogs, significantly contribute to morbidity in the pediatric population. In Mexico, an incidence rate of 110 cases per 100,000 people is reported. The elevated morbidity is linked to the potential for infection due to the high bacterial load in canids saliva, coupled with their powerful jaw force, causing extensive tissue destruction.[1]

The treatment pillar is centered on infection prevention through measures like thorough washing and debridement, combined with early primary reconstruction. However, some cases may experience an unsuccessful development, resulting in a complex-to-treat wound.[2]

In the presented case, we discuss a pediatric patient with a dog bite on the pelvic limb featuring a challenging-to-manage wound. This case was effectively addressed with a skin graft on a bed of collagen matrix secured with negative pressure therapy.

CASE REPORT

A 6-year-old male patient arrived at the pediatric emergency service three hours after sustaining a dog bite on his right leg. The patient had no significant past medical history, and vital signs were within normal parameters upon physical examination. A concise, blunt wound was observed on the back of the right leg, involving the skin, subcutaneous tissue, and muscle (Figure 1), with no other notable findings.

Figure 1 (A and B): Lesion on the posterior side of the right leg with the presence of a skin flap

Initially, the patient underwent cleansing with various solutions, including chlorhexidine, iodine, and hypochlorite. Local anesthesia with lidocaine, tailored to the patient's weight, facilitated edge remodeling and primary closure. Simple 4-0 nylon sutures were used for the skin, while inverted polyglactin 910 sutures were employed for the subcutaneous tissue (Figure 1). Upon discharge, the patient received a dual antibiotic regimen comprising amoxicillin with clavulanic acid and clindamycin adjusted for weight.

Despite initial management, the patient experienced a torpid course marked by infection and necrosis of the dermal flap. Following a culture-guided infection mitigation strategy, necrotic tissue was excised to prepare the graft bed (Figure 2).

Figure 2: Removal of necrotic tissue for graft recipient bed preparation.

Seven days later, lidocaine with epinephrine was used for infiltration, and bed was cleansed using a plasma-sterilized metal sponge. Graft harvesting involved superficial infiltration of lidocaine and epinephrine in the right thigh within a pre-defined area based on wound size. With a dermatome, a 0.6 mm sheet of skin was meshed. A collagen and elastin dermal matrix were applied to the prepared bed, and the graft was secured with continuous 4-0 polyglactin 910 sutures. An intermediary, coated surgical fabric with bacitracin ointment was used before placing a black sponge and a continuous negative pressure system set at 50 mmHg. Dressing and sponge changes occurred after seven days, with final revelation in following seven days (Figure 3).

Figure 3: Skin graft seven days post-insertion.

DISCUSSION

In dog bites, the significance of prompt and expeditious care, coupled with the judicious management decisions provided to the patient, constitutes the primary attributes for an appropriate recovery. However, these wounds should be recognized as contaminated injuries, given the diverse array of microorganisms present in canines, encompassing more than 64 species harmful to humans.[3] Typically, infections arising from these bites involve a multitude of microbial types, with the most prevalent pathogens being *Pasteurella*, *Staphylococcus*, and various anaerobes such as *Bacteroides*, *Fusobacterium*, and *Prevotella*, presented in order of prevalence. Notably, *Pasteurella multocida* has been identified in approximately half of all dog bites. The duration between the incident and the receipt of medical attention emerges as a pivotal factor in predicting the risk of infection, thereby complicating the healing process.[4]

There is an imperative need for broader dissemination of information regarding dog bites, mainly targeted at parents who share their homes with dogs. Such efforts could significantly reduce incidence of injuries stemming from this cause.

If necrotic tissue is present, its removal is imperative until healthy tissue develops. However, this process presents

challenges, including the risk of damaging surrounding healthy tissues and encountering profuse bleeding. Various methods exist for removing necrotic tissue, encompassing mechanical approaches such as pressurized water, electrocautery, or scalpel use and chemical methods employing enzymes to break down dead tissue. However, these methods may induce morbidity, prompting the preference for measures with minimized collateral damage. Ayaz reported the successful use of the scrub sponge in 2,500 patients, demonstrating efficacy, speed, and safety in achieving desired outcomes.[5]

Negative pressure wound therapy (NPWT), commonly known as VAC, has been prevalent since 1997, effectively addressing chronic, acute, and subacute wounds. Widely integrated into plastic surgery practices, this therapeutic approach induces micro deformations on the wound surface, fostering cell proliferation and angiogenesis, thereby expediting wound healing. Notably, this suction effect accelerates healing, reduces costs, and diminishes waiting times.[6,7]

In plastic surgery, VAC has become a routine adjunct to graft procedures, offering stability and mitigating integration challenges such as seroma formation, hematoma and shear forces.[6] Additionally, dermal matrix, a membrane composed of lyophilized acellular collagen 1/2 mm thick, featuring bovine dermal collagen types I, III, V and hydrolyzed elastin, is valuable tool. These skin substitutes act as direct source of collagen for fibroblasts, promoting neovascularization and cell migration.[8]

Treating dog bites requires a meticulous initial cleaning to reduce bacterial load and infection risks, followed by appropriate coverage. Contrary to historical practices, recent studies support primary closure for dog bites with thorough cleaning, demonstrating minimal infection rates. In our case, wound's bed was unsuitable for early grafting.[9] Despite option to delay grafting until infection eradication, the wound's high morbidity led us to opt for a clinically infection-free bed. We employed dermal matrix with negative pressure therapy, resulting in patient's favorable evolution without infection development. From cost-benefit perspective, these resources contribute to accelerated healing by reducing treatment duration.[10]

CONCLUSION

Managing dog bites, known for their complexity, requires a versatile arsenal of treatment options. Combining graft, dermal matrix, and negative pressure therapy is a practical and reproducible approach, showcasing its utility and efficacy.

Dog bites pose a persistent challenge to public health, as they account for a significant portion of emergency consultation complaints, particularly affecting pediatric patients. Given their inherent nature, these incidents can result in challenging-to-manage wounds. Therefore, it is crucial to employ diverse treatment modalities. Skin graft combined with dermal matrix and negative pressure therapy constitutes a valuable and easily reproducible combination in addressing such cases.

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