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## Research Article

# Surgical wound management and healing time in *Iguana iguana*

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**ABSTRACT -** Wound healing in reptiles occurs within the same phases noticed in mammals. Our objective was to record the surgical wound healing of an *Iguana iguana*, registering the management steps and the healing time. The animal had a firm mass at the submandibular region, which was surgically removed, and the phases of healing were registered by photographs. After surgery, the individual showed a great improvement in its health. The healing time was in accordance with publications, but not the length of time nor the degrees of the phases. These results could be justified as a stress response.

## CASE REPORT

A green iguana (*Iguana iguana*), male, measuring SVL = 39 cm and CL = 90 cm, weighing 2.015 kg, from the woods of the Campus of the Universidade Federal do Ceará (UFC), was brought by students to the Núcleo Regional de Ofiologia of the same university (NUROF-UFC). The animal had a normal body condition, but it was apathetic, with a left head tilt and a serosanguineous discharge in the left eardrum. It was unable to climb any tree and it seemed unbalanced, because its stance was abnormal. In the submandibular region, a firm mass was detected, measuring 29.6 x 31.3 x 24.6 mm, which appeared to be an abscess (Fig. 2A). It was prescribed systemic antibiotics and anti-inflammatory drugs to improve the clinical signs.

## MATERIALS AND METHODS

After one week, the mass was surgically removed, with the surrounding integument. Macroscopically, it was found not to be an abscess but most likely a fibroma, which was sent for histology for subsequent analysis. Postoperatively, it was prescribed systemic antibiotics and anti-inflammatory drugs, topical therapy with penicillin and urea balm once a day, and an occlusive bandage, changed daily, for five days. During recuperation, it was offered fluid, nutritional and thermal care as well. A well-balanced assisted-feeding diet was given (greens, fruits, vegetables; kale, mango, banana, sweet potato, Leucaena's leaves and water) along with sun bathing (8 hours light/day, on average), in which the patient would reach the optimum temperature of 34.5°C. After the five days, the occlusive bandage was removed and the healing process continued with the lesion exposed, being registered by daily photographs. The healing time was analysed.

 

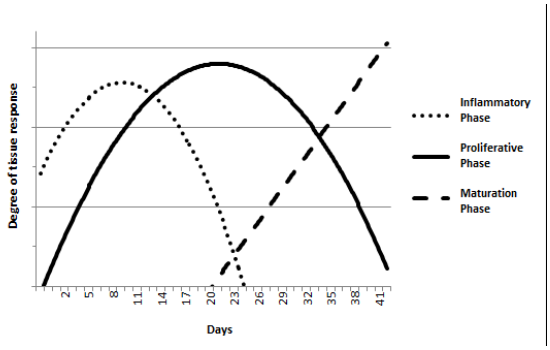


**Figure 1.** Phases of surgical wound healing in *I. iguana*. Note the overlapping phases.

## RESULTS AND DISCUSSION

The surgical wound measured nearly 10 $cm^2$ (Fig. 2B). It was not sutured but cauterised, leaving anterior and posterior pterygoids partially exposed. To remove the submandibular mass, surgical techniques described by Mader (2006) were utilised, in which the overlying skin is removed and the wound is cauterised, instead of being sutured. According to these techniques, the preservation of the integument could allow the development of a new abscess, due to the permanence of the fibrous capsule. As the primary approximation of the surgical edges is not possible in this technique, second intention healing was chosen, in which the wound is left open, delaying healing three or four times more than by first intention. In the absence of interference factors, such as underlying diseases or husbandry defects, the normal healing process should be completed in four to six weeks (Mader, 2006).

The use of an occlusive bandage was a temporary option, in order to stabilise the inflammation, remove debris, and protect against desiccation and secondary infection until the onset of granulation. The use of this bandage technique was suggested by Mitchell & Diaz-Figueroa (2004) for a limited period of two to four days. After abandoning the occlusive bandage, the wound was kept open, being washed with saline solution daily.

The healing process in reptiles depends on high environmental temperatures, as well as appropriate nutrition (Smith & Barker, 1988; Cooper, 2006). Maintenance of the patient in the upper end of its optimal range has been shown to promote healing, with cranial to caudal oriented wounds healing faster than transverse wounds (Mader & Bennett, 2006). It took 42 days for complete fibroplasia.

The wound evolution was classified in minimum, medium and maximum degrees of inflammation, proliferation and maturation, considering the macroscopic features observed in each phase, based on Clark & Denver (1985), represented in Fig. 1. During the inflammatory phase, the wound was erythematous and exudative, with vestigial blood clots (Fig. 2C). The inflammation reached the maximum degree around the 14$^{th}$ day after surgery, showing the maximum edema, exudation and erythema (Fig. 2D). The maximum degree of inflammation contradicts the publications (Maderson & Roth, 1972; Smith & Barker, 1988), which have shown the inflammatory response in lizards is minimal.

The length of the inflammatory phase, which was expected to be approximately three days (Contran et al., 1996; Tazima et al., 2008), was observed to be longer in this individual. The inflammatory findings on the 14$^{th}$ day after the injury are in contrast with French et al. (2006), who found the total healing length was no longer than 17 days, and this could have been justified by a stress response (excessive manipulation, restraint, confinement). The inflammation phase is the most stress-sensitive, and when the animals are submitted to environmental and husbandry changes it increases the blood corticosteroid concentration, delaying the biochemical events of healing (French et al., 2006).

At the proliferative phase, the development of the granulation tissue, pale and finely granular, was visualised, along with the gradual enlargement of the desiccated fibrin clot in the wound centre, while the fibroplasia started to develop on the periphery, centripetally (Fig. 2E,F), which is consistent with other works (Tazima et al., 2008; Isaac et al., 2010). The maturation phase is characterised by wound contraction and scar remodelling.

The initial wound area, which measured approximately 10 $cm^2$, had been reduced to nearly 4.5 $cm^2$ at the 38$^{th}$ day of observation (Fig. 2G, H, I). The peripheral tension should reduce after eight weeks, enlarging the scar area, since the inclination of the maturation curve is more acute in the first six to eight weeks after the injury (Tazima et al., 2008). In this case report, reepithelialisation would not be


**Figure. 2.** Photographic registration of surgical wound healing in *I. iguana.* (A) Submandibular mass, possibly abscess. (B) Day 0 = surgery moment. (C) Day 1 = start of inflammatory phase, exudation and blood clots. (D) Day 14 = maximum degree of inflammatory response. (E) Day 19 = granulation tissue and peripheric fibroplasia. (F) Day 24 = desiccated fibrin clot. (G) Day 32 = maximum degree of wound contraction; decrease of granulation tissue, start of maturation. (H) Day 36 = wound contraction, maturation. (I) Day 42 = Total wound fill with matrix of collagen, maturation.

noticeable, most likely due to wound depth and the destruction of the epidermal stratum germinativum, stopping the production of new keratinocytes.

With regard to the general condition of the individual after the surgery, there was a great improvement in its health status. After the first two weeks, the green iguana had recovered its normal balance, gait, and state of consciousness. It was alert and sensitive to external stimuli and started to move and climb regularly. The second intentional healing in *I. iguana*, with the correct fluid, nutritional and thermal care, developed within the period described in publications. Although the healing process and its phases occur in biochemical and physiological similarity to mammals, the dependence on environmental temperature is one of the reasons for the differences in the process.

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