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CASE REPORT
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Reconstructive Surgical Repair of a Forth Degree Iatrogenic Burn in a Dog

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ABSTRACT

***Background*:** Burns are uncommon in small animal surgery routine and represents a real therapeutic challenge. Skin can be affect in different degrees of deepness as superficial, partial thickness, full thickness and full thickness affecting underlying tissues. Each degree has individual features. Progression through degrees can occur in the first 24 h or if treatment is inadequate. This paper aims to describe therapeutic approach and surgical technique to treat a huge dorsal iatrogenic thermal burn injury.

***Case*:** A 4-year-old female German Shepard was referred to veterinary hospital after 11 days of elective ovariosalpingohisterectomy. The patient presented a severe skin injury with crusts, eschars, purulent discharge and myiasis on dorsal cervical, thoracic and lumbar region. Beside severity of the wound, animal present good general status and normal vital signs. Complete blood count and biochemical analysis were within normal ranges. Histopathologic analysis of a wound tissue sample revealed the presence of coagulation necrosis and inflammatory response. The absence of traumatic events, histopathologic result and wound features increased suspicious of an iatrogenic burn injury from a poorly regulated thermal mattress used during surgical intervention. "Rule of Nines" was estimated as 25% of total body surface area. Systemic antibiotics and topical treatment with 0.05% chlorhexidine digluconate and 2.5% silver sulfadiazine ointment followed by wet-wet bandage was performed after initial surgical debridement. Muscle and vertebral bone explosion were evident. Topical treatment with Silver Sulfadiazine and chlorhexidine persisted twice daily until granulation tissue formation. Pain killers and sedation were often necessary during bandage changes. At 65th day proceeded to *en bloc* excision of scar tissue and surgical reconstruction with skin advancement and recruitment technique. Tie-over dressing was applied to cover the final wound. After 14 days animal received hospital discharge, and was assessed bi-weekly for 60 days.

***Discussion*:** Besides great extension of the burn injury, patient's age, absence of systemic involvement and fluid therapy or critical care the prognosis was good. Modified "rule of nine" are used to estimate wound size in dogs. The wound was classified as forth degree or full thickness injury due to exposed muscular layer and bone. Early debridement, standard topical and systemic treatment protocol applied granted good recovery of wound bed. Due to be uncommon in small animal routine, main diagnosis and therapeutic recommendations for veterinary patients are based on human data. Systemic antimicrobial drugs are usually not recommended due to low concentration in burned tissues, however, prophylactic use was necessary due to highly infected tissues and possible bacterial absorption from devitalized tissues. Delayed primary closure technique was necessary due to highly infection site and extension, which turns surgical approach hard to perform. After formation of a granulation tissue bed for wound reconstruction, surgical treatment was performed. Surgical reconstruction is indicated in large full thickness defects and for better cosmetic appearance. The correct use and regulation of thermal mattress can avoid burns that can be life threatening. This case report rises the important concept that even low contact temperatures when persistent for long time can cause burn injuries.

Keywords: thermal, mattress, injury, dogs, plastic.

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INTRODUCTION

Severe burn injuries are uncommon and a real therapeutic challenge in veterinary medicine [1]. Burns occurs when thermal energy is applied in a rhythm greater than tissue capacity to absorb and dissipate [2]. Cellular necrosis is caused when the touched object or environment is too hot or the contact is too much long [3].

The modern burn injury classification system refers to how deep skin was affected. It can be differentiated as superficial (first degree), partial thickness (second degree), full thickness (third degree) or, forth degree (lesions deep enough to affect underlying tissues) [8]. Each degree has individual features and progression can occur in the first 24 h of injury or if treatment failure in stabilize the secondary lesions (released prostaglandins, proteolytic enzymes and vasoactive substances) [2,8].

This paper aims to describe the occurrence of a severe huge iatrogenic burn injury caused by a thermal mattress and its medical and surgical therapeutic approach, as well as long term outcome.

CASE

A 4-year-old, neutered female German Shepard weighting 30 kg was referred to veterinary hospital with an 11 days history of elective ovariosalpingohisterectomy post-operatory. The animal presented with multiple infected skin lesions with myiasis and purulent discharge on dorsal cervical, thoracic and lumbar region. The patient was alert and conscious, presenting good general status, without signs of dehydration, good arterial pulse quality, rosy mucous membrane, rectal temperature of 38.5ºC and absent of any abnormal cardiopulmonary sound. The wound had crusts and eschars in the epidermal layer, covered with thick hairy coat (Figure 1A). After hair removal and wound cleaning, it was observed exposed muscular layer and spinous process of thoracic and lumbar vertebrae (Figure 1B). The owner did not report any traumatic injury before or after surgery, consistent with wound features. All post-operative drugs were provided as prescribed, i.e. cephalexin[1] (25 $mg.kg^{-1}$ PO q12 h) for 7 days, meloxicam[2] for 5 days (0.1 $mg.kg^{-1}$ PO q24 h) and dypirone[3] (25 $mg.kg^{-1}$ PO q8 h) for 5 days. The owner did not observe the injury immediately after the surgery, but it appeared as a hard thick blackish skin below hair layer. It was assumed that wound originated from a poorly regulated thermal mattress used for temperature control on perioperative period associated or not to an electrocautery plate. Based on "Rule of Nines", estimated burn extent was considered 25% of total body surface area. Complete blood count and biochemical panel were within normal parameters range. The authors believe that high temperature/contact time of a thermal mattress was the cause of the iatrogenic burn.

During anesthesia for initial surgical debridement, a tissue sample was obtained and sent for histopathologic analysis, which shown diffuse coagulation necrosis with intense neutrophilic inflammatory reaction. Superficial layer of necrotic and eschar tissue was excised, as well as copiously cleaned with 0.05% chlorhexidine digluconate solution. Based on histopathologic features and patient history, the definitive diagnosis was thermal burn injury. After surgical debridement patient was treated with enrofloxacin[4] (10 $mg.kg^{-1}$ PO q24 h during 10 days), metronidazole[5] (25 $mg.kg^{-1}$ PO q12 h during 7 days), meloxicam[2] (0.1 $mg.kg^{-1}$ PO q24 h during 7 days), tramadol hydrochloride[1] (6 $mg.kg^{-1}$ PO q8 h during 7 days) and dipyrone[3] (25 $mg.kg^{-1}$ PO q8 h during 7 days). Topical treatment carried out twice daily, using isotonic solution with 0.05% chlorhexidine digluconate followed by silver sulfadiazine 2.5% ointment application and wet-wet bandage with dressing.

Topical treatment was performed for 64 days until onset of granulation tissue formation and beginning of wound contraction (Figure 1C). Analgesics was administered only when necessary, mainly before dressing changes. On 65th day after initial presentation, the animal was subjected to plastic-reconstructive surgery for a huge extent wound closure.

A 2 cm-margin incision was made around the back injury to remove contracted scar tissue (Figure 1D). This scar tissue was excised *en bloc,* since it was poorly vascularized. Subcutaneous tissue divulsion was performed up to mammary gland line in order to allow skin advancement (Figure 1E). Wound edge approximation was possible by application of 6 subcutaneous modified "walking" sutures using 2-0 polyglactin 910 on both sides. A subcuticular suture pattern with 3-0 polyglactin 910 was applied in order to skin union followed by simple interrupted pattern skin sutures with 3-0 monofilament nylon. Four tension-relief sutures in cruciate pattern was made with 0 polypropylene along

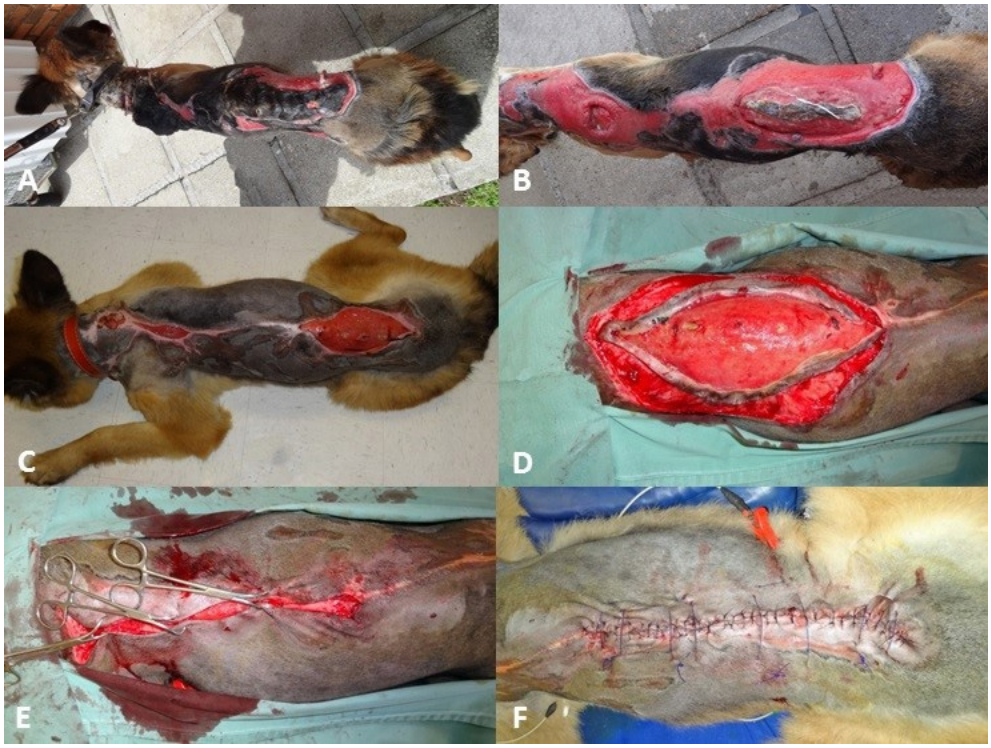

Figure 1. A 4 year-old bitch with a full thickness (Fourth degree) burn injury by thermal mattress after ovariosalpingohysterectomy. A- Crust lesion adhered to dorsal cervical, thoracic and lumbar region. B- After crust excision, and surgical debridement. C- 64 days after treatment beginning with 2.5% silver sulfadiazine ointment and dressing. Decrease of wound area and presence of health granulation tissue are evident. D- Scar tissue incision with 2 cm margin. E- Surgical view of temporary occlusion of wound defect with towel clamps after subcutaneous divulsion and skin recruitment with walking sutures. F- Final appearance after complete reconstruction of the dorsal injury. Skin sutures and tension relief sutures are observed.

the surgical wound (Figure 1F). A compressive dry-dry, gauze and cotton based bandage was made, and maintained for 3 days. Cover layer was maintained in place through tie-over dressing.

On post-operative period of 7 days was used tramadol hydrochloride[1] (5 $mg.kg^{-1}$ PO q8 h), cephalexin[1] (25 $mg.kg^{-1}$ PO q12 h), dipyrone[3] (25 $mg.kg^{-1}$ PO q8 h) and meloxicam[2] (0.1 $mg.kg^{-1}$ PO q24 h). Patient was assessed every 12 h during the first 7 days, when little serosanguineous fluid accumulation was observed during each dressing change. Less pain, and discomfort during dressing changes was observed after surgical procedure. Compressive bandages were maintained until suture withdrawal, 14 days post-operative (Figure 2A). After that, it was assessed bi-weekly for 60 days, and mild scar tissue occurred as well as slow hair growth (Figure 2B).

DISCUSSION

Five factors determine the severity of a burn injury, it is the depth, size, region involved, age and general condition of the patient [8]. Burn wounds are different from traumatic wound due to its unique features and therapeutics [1]. In the case reported, the animal had a huge severe burning, however, being young and without systemic involvement, the prognosis was considered good. Due to 11-days old history of a possible iatrogenic burn and absent of dehydration, fluid therapy and critical care was not necessary.

At presentation, patient's recent history, physical examination and lesion pattern was highly suggestive of iatrogenic burn injury caused by dysregulate thermal mattress with high temperature and/or prolonged exposure direct to patient skin. The wound presented secondary contaminated with tissue eschar, crusts, parasites and purulent discharge. Standard protocol for local treatment of a wound was applied as recommended, consisting of wide shaving, cleaning with isotonic and antiseptic solution and early debridement, in order to decrease progression of the injury, bacterial infection and

Figure 2. Plastic-Reconstructive post-operative results. A- Wound aspect 14 days after reconstructive surgery, at stitches removal moment. B- After 60 days of suture removal, entire surgical region covered with hair. Only a small scar could be seen.

increase efficiency of topical treatment [7]. Due to be uncommon in small animal, the majority of diagnostic and therapeutic recommendations are based on human data [1].

Due to the exposed muscular and spinous process of thoracic and lumbar vertebrae the lesion was classified as a forth degree full thickness injury [8]. Systemic antimicrobial drugs are not recommended, because they do not reach adequate concentration in burned tissues [4]. However, in this case, it was used as prophylactic of systemic complications due to highly infected tissue and the neovascular formation, which could favor the absorption of bacterial from the devitalized tissue.

Currently classification of burns is based on the layer of tissue affected. Fourth Degree burn injury occurs when there is destruction of all cutaneous layers, as in full thickness lesion, plus exposure of deep tissues, including muscles and bones [8]. Fourth degree burns are often associated with systemic clinical signs. This did not occur in our patient. “Rule of Nine” adapted for dogs is used to estimate wound size. High burned body surface is linked to poor survival rate [8].

Silver sulfadizine ointment is considered the gold standard topical treatment of burn wound, because of his broad antimicrobial spectrum and good tissue penetration, even on devitalized eschar, and few collateral effects [5,9]. Early debridement is a key point of treatment in burned patients due to stimulate metabolic response, reduce bacterial infection, decrease risk of sepsis and promotes faster health vascular bed for reconstruction [6,8]. Conservative debridement is used when surgical one is hard to perform due to deep tissues adherences. In order to perform conservative debridement, we used wet-wet bandages, isotonic solution for humidify the wound and twice a day dressing changes [1,8].

In order to allow surgical intervention was necessary to wait health granulation tissue formation, what required about 60 days of intensive topical treatment. However, after surgical repair, recovery was fast, and about 15 days later the animal was discharged from the hospital. Use of skin advancement associate with skin recruitment technique, such as walking suture, subcutaneous divulsion, and tension-relief sutures allowed adequate closure of this huge defect, even after total excision of the wound scar. Surgical reconstruction is indicated mainly in large full thickness defects and for better cosmetic appearance, due to less scar formation and more hair growth when compared to second intention closure [8]. In this case, we used a delayed primary closure technique with good final results and fast recover.

On burned patient management it is vital to identify the source, degree of local and systemic commitment, electrolyte stabilization when necessary and early institute of infection control, debridement, stimulation of granulation tissue and, when necessary, plastic-reconstructive techniques application. Correct use and regulation of thermal mattress can avoid burn injuries, which, when large and severe, can be life threatening. An important concept to keep in mind: even low contact temperatures, when persisted for long periods, can cause burn injuries.

MANUFACTURERS

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Declaration of interest. The authors report no conflicts of interest. The authors alone are responsible for the contents and writing of the paper.

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