

Surgical Management of Tail Gangrene and Necrosis in Long-Tailed Male Kashmir Merino Sheep : A Retrospective Study

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Abstract

This retrospective study evaluated the etiology, clinicopathological patterns, and surgical management of tail gangrene and necrosis in 22 long-tailed male Kashmir Merino sheep presented to a Teaching Veterinary Hospital between 2019 and 2024. The most common causes were dog bites (31.8%), flystrike (22.7%), crush injuries (18.2%), and malicious docking (13.6%), with the tail tip being the most frequently affected region (68.2%). Dry gangrene predominated (68.0%), whereas moist gangrene accounted for 32.0% of cases. A statistically significant association ($p < 0.01$) was observed between injury etiology and gangrene type, with traumatic ischemic injuries resulting in dry gangrene and contaminated wounds leading to moist gangrene. All animals underwent surgical tail amputation cranial to the affected tissue under posterior epidural anaesthesia, followed by standard antimicrobial and analgesic therapy. Complete recovery without postoperative complications was achieved in all cases (100%). The findings confirm tail amputation as an effective and welfare-oriented therapeutic intervention for advanced tail gangrene and emphasize the severe consequences of improper docking practices.

Keywords: Merino; Tail diseases; Management; Tail amputation; Gangrene; Necrosis

Introduction

Sheep is considered a pivotal livestock species and contributes significantly to the agricultural economy, particularly in supporting the livelihoods of small and marginal farmers and landless labourers (Lalit *et al.*, 2016). The Kashmir Merino, a key crossbred strain in the region, is characterized by a long, cylindrical tail that is thick at the base and tapers towards a thin tip (Tomar, 2004).

The tail serves as a versatile organ in farm animals, facilitating communication, locomotion and comfort, particularly through fly-swatting and social signalling. However, this functional importance also made it susceptible to a wide spectrum of pathological conditions including dermatitis, trauma, fractures, paralysis, necrosis, gangrene and discospondylitis (Nuss and Feist, 2011). When such conditions were severe and refractory to medical management, surgical amputation cranial to the affected tissue became a necessary therapeutic intervention (*loc. cit.*).

Although therapeutic amputation is often justified, the practice of tail docking in lambs—commonly performed for hygienic reasons—raises important animal welfare concerns. Invasive methods such as hot-iron docking resulted in acute and chronic pain, neuroma formation and impaired communication, as documented in behavioural and physiological studies (Lester *et al.*, 1996; Mellor and Stafford, 2000). Therefore, any decision to amputate

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must be ethically justified, ensuring that alleviation of existing suffering outweighs the stress associated with surgical intervention.

The present paper reports the etiology, statistical associations and successful surgical management of tail gangrene in Kashmir Merino sheep.

Material and Methods

Retrospective analysis of medical records from the Veterinary Clinical Complex, Faculty of Veterinary Sciences and Animal Husbandry, Shuhama, SKUAST-K, was conducted for the period 2019-2024. The review identified 22 long-tailed Kashmir Merino sheep presented with gangrenous tail injuries that were unresponsive to medical management and required surgical amputation.

Surgical Technique and Outcomes

All rams underwent tail amputation. The precise disarticulation site was determined by palpation cranial to the gangrenous tissue. The surgical site was prepared, and posterior epidural anaesthesia was administered using 2 ml of 2% Inj. Lignocaine hydrochloride. A tourniquet was applied, and a U-shaped skin incision was made to create triangular skin flaps, followed by disarticulation at the intervertebral space. The coccygeal arteries were ligated, and the skin was apposed with simple interrupted sutures using PGA 2-0 suture material (Fig. 4).

Postoperatively, all animals received Inj. Ceftriaxone @ 10 mg/kg body weight intramuscularly for five days and Inj. Meloxicam @ 0.5 mg/kg body weight intramuscularly for three days, with daily antiseptic dressings (betadine). All 22 animals (100%) experienced uncomplicated healing with no instances of surgical site infection, dehiscence, or requirement for a second intervention, resulting in an uneventful recovery.

Results and Discussion

Total of 22 animals with gangrenous tail injuries were presented and dog bites were the most common etiology (31.8%), followed by flystrike (22.7%).

The tail tip was the most frequently affected region (68.2%), as detailed in Table 2. The affected animals were aged 1-4 years. Dry gangrene was present in 15 sheep (68%), while 7 (31.8%) presented with moist gangrene.

A significant association was found between the etiology of the injury and the type of gangrene that developed ($p < 0.01$, Fisher's Exact Test).

As detailed in Table 3, traumatic injuries that primarily cause vascular disruption without significant bacterial contamination (malicious docking, tail crush, tail fracture) were exclusively associated with dry gangrene. In contrast, injuries that introduce massive bacterial contamination (dog bites, flystrike) showed a strong tendency to develop moist gangrene (Fig 1 -3).

This retrospective study of 22 clinical cases provided a detailed analysis of the causes, patterns and management of tail gangrene in Kashmir Merino sheep. The statistically significant associations identified in the present investigation contribute to a clearer understanding of tail pathology. The observed relationship between etiology and type of gangrene was pathophysiologically related. Dry gangrene, resulting from ischemic necrosis, was associated with injuries causing vascular compromise without major contamination, such as tail crush, fractures and thermal injury due to hot-iron docking (Nuss and Feist, 2011; Drolia *et al.*, 1991). In contrast, moist gangrene, characterized by superimposed infection, was predominantly associated with contaminated

injuries such as dog bites and flystrike (Ural *et al.*, 2007). This distinction was clinically important, as cases of moist gangrene may necessitate more aggressive and targeted antimicrobial therapy.

The significant association between injury location and etiology further suggested that the tail tip was the most vulnerable region, due to its peripheral location and greater exposure to trauma. Conversely, injuries involving the thicker and more proximal regions of the tail generally required greater traumatic force, most commonly inflicted by predators or crushing mechanisms. This understanding can assist clinicians in forming early diagnostic suspicion during physical examination.

Tail docking in lambs had traditionally been advocated to reduce faecal soiling, a known predisposing factor for flystrike (French *et al.*, 1994). However, the hot-iron method of docking had been shown to induce acute cortisol responses and significant physiological and behavioural stress, raising serious animal welfare concerns (Lester *et al.*, 1996; Mellor and Stafford, 2000).

In the present study, all animals presented with advanced tail gangrene, severe discomfort and failure of conservative medical management, thereby fulfilling the ethical justification for surgical amputation—namely, that alleviation of existing suffering outweighs the stress associated with the surgical procedure (Nuss and Feist, 2011). These findings were consistent with earlier reports identifying amputation as the only effective therapeutic option in cases of advanced tail necrosis and gangrene (Ural *et al.*, 2007; Drolia *et al.*, 1991).

The 100% surgical success rate observed validated the described technique. This consistent outcome, irrespective of the initial etiology, underscored the robustness of the procedure and can be attributed to amputation through healthy tissue, meticulous haemostasis,

tension-free closure using skin flaps and appropriate postoperative medical therapy.

The economic implications of tail gangrene are considerable and include reduced market value, loss of a vital organ involved in communication and fly deterrence, and increased treatment costs. Although tail disorders may initially be managed conservatively, the findings of the present study confirmed that severe gangrenous conditions rarely responded to medical therapy alone and ultimately required surgical intervention (French *et al.*, 1994). Early and decisive surgical management following failure of conservative treatment is therefore both a welfare-driven and economically sound strategy.

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Table 1. Etiology of Gangrenous Tail Injuries in Sheep (n=22)

S. No.	Causes of injury	No. of sheep involved
1	Tail Crush	4
2	Tail Fracture	3
3	Fly Strick	5
4	Malicious Docking	3
5	Dog Bite	7
Total		22

Table II. Anatomical Location of Tail Injuries (n=22)

S. No.	Causes of injury	No. of sheep involved
1	Tip of tail	15
2	Middle of tail	4
3	Base of tail	3

Table III. Association between Etiology and Type of Gangrene (n=22)

Cause of Injury	Dry Gangrene (n=15)	Moist Gangrene (n=7)	p-value
Dog Bite	3	4	< 0.01
Flystrike	2	3	
Tail Crush	4	0	
Tail Fracture	3	0	
Malicious Docking	3	0	



Fig. No. 1: Chronic ulcerated wound on tail tip



Fig. No. 2: Fly Strike wound at the head of the tail



Fig. No. 3: Fracture of the coccygeal vertebrae at the tip



Fig. No. 4: Skin Suture of tail stump after amputation