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Original Article

Trial of induction of pilonidal sinus disease in rat models

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Abstract

Introduction

Pilonidal sinus disease is a common suppurative perianal condition. The aim of this trial is to create an animal model of pilonidal sinus disease to study and compare the mechanism of action of numerous medications.

Methods

Ten adult Sprague-Dawley rats were enrolled in the study. They were separately housed in polypropylene cages. They were fed normal chow. The rats were anesthetized with Ketamine and Xylazine (At a ratio of 3:1) through intramuscular injection into their proximal thigh. The back of each rat was shaved, and a sample of the hair rat was obtained and labeled. After clearing the back of the animal, a vertical 1 cm incision was inflicted upon the dorsal side of each rat with a blade 15' and a tuft of hair composed of at least 20 fibers was embedded in the wound, later the wound was closed by 4.0 proline suture material in a simple interrupted fashion. The rats were followed for a period of 4 weeks.

Results

Macroscopically, the rats showed 0.5x0.5 cm nodules at the side of the injury at the 5th week. As there was no draining sinus, the picture in this form cannot be regarded as a typical pilonidal sinus, it was more consistent with a foreign body granuloma. No pilonidal sinus could be reported.

Conclusion

Rat is not a suitable animal for the induction of pilonidal sinus disease.

1. Introduction

Pilonidal sinus disease (PNS) is a common intermittent long-standing suppurative lower back condition [1]. It is linked with substantial morbidity and has an important social effect on patients. Although the etiology is not well understood, most authors agree that it is an acquired condition [2]. The clinical manifestations are the same as the classical inflammatory patterns that include hotness, pain, tenderness on pressure, and erythema. Discharge is the hallmark of the disease. Being male and driver is the most crucial identified risk factor [3]. Cellulitis, local recurrence, and abscess formation are the prominent complications after surgical intervention. Although very uncommon (0.1%), a malignant transformation could occur. The pathogenesis of the malignant transformation is thought to be a failure of the natural repair mechanisms that are usually found in chronic wounds, scars, ulcers, and fistulas [4].

As the non-operative management of PNS is growing, an animal model of PNS is necessary to test new drugs, assess their effect, analyze their mechanism of action, and report the side effects.

The aim of this trial is to create an animal model of PNS to study and compare the effects of various compounds on the disease.

2. Methods

2.1. Setting

Ten adult Sprague-Dawley rats (5 males, and 5 females, weighing between 170-220 grams and aged between 7-8 weeks) were enrolled in the study. They were separately housed in polypropylene cages at a room temperature of 22 Co (+-1) with an alternating 12/12 hours day and night lighting cycle. They were fed normal chow.

2.2. Procedures

The rats were anesthetized with Ketamine and Xylazine (At a ratio of 3:1) through intramuscular injection into their proximal thigh. Following the induction of anesthesia, the back of each rat was shaved, and a sample of rat hair was obtained and labeled. After clearing the back of the animal, a vertical 1 cm incision was inflicted upon the dorsal side of each rat with a blade 15', and a tuft of hairs composed of at least 20 fibers was embedded in the wound, later the wound was closed by 4.0 proline suture material in a simple interrupted fashion (Figure 1).

2.3. Follow-up and outcome measure

The rats were followed for a period of 4 weeks, during which the wounds were cleaned using Iodine every other day. The suture materials were removed on the 7th postoperative day. On the 5th postoperative week, two rats (one male and one female) were sampled. The specimens were taken from the wound and put in formaldehyde to be prepared for histological examination, and on the 6th week, the procedure was repeated for two other rats to see the progress of the disease, and finally, in the 7th week, the remaining 6 rats were sacrificed and the wounds were excised to be histologically examined for any trace of PNS.

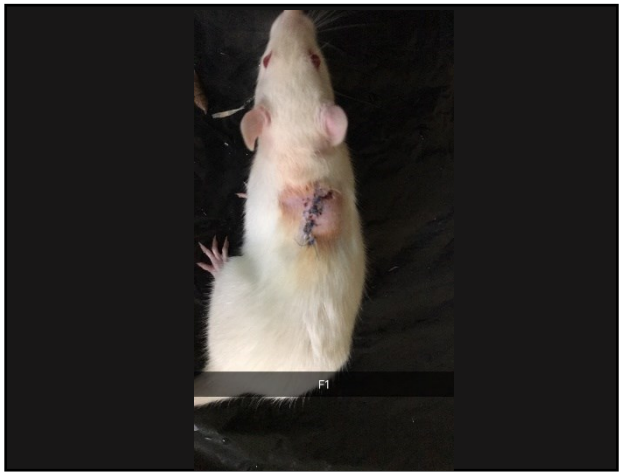

Figure 1. incision, embedding hairs, and closure of the wound.

3. Results

Macroscopically, the rats showed 0.5x0.5 cm nodules at the side of the injury in the 5th week. The samples which were taken during the early period of the experiment (5th week) showed an intact dermis and epidermis with some degree of fibrosis, a deeply seated granuloma was seen surrounding the fragments of the hair shaft, composed of aggregates of histiocytes with giant cells (both Langhans and foreign body types) surrounded by lymphocytes and plasma cells, associated with congestion and foci of acute inflammatory changes and abscess formation (Figure 2). As there was no draining sinus, the picture was more consistent with a foreign body granuloma. No typical PNS could be reported from the trial.

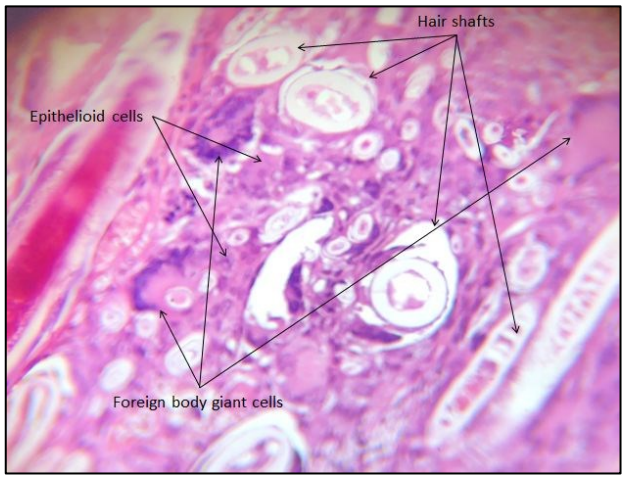

Figure 2. A deeply seated granuloma is seen surrounding the fragments of the hair shaft.

4. Discussion

One of the biggest organs in any living thing, including rats, is the skin. It is a crucial component in separating the body from

the outside world. The rat's skin does not have a morphologically uniform structure and covers the entire body surface, making up about 15% of its body weight [5]. Numerous experiments can be conducted on rats despite the structural dissimilarity between human and rat skins. Due to its functional resemblance to human skin, it makes it possible to assess the risks and benefits of suggested therapies and medications [6,7]. All mammals' skin exhibits a layered structure and has nearly a similar structure. The outermost layer of the skin, the epidermis, has an ectodermal origin. Dermis, subcutaneous adipose tissue, nerves, musculature, and vessels are all mesodermal-derived structures [5].

Ideal PNS in an animal model is crucial for understanding new medications and herbals that have recently been introduced in the literature. In a controlled randomized trial among 400 patients, Salih et al. examined the effect of a herbal mixture on PNS. They found that conservative measures with herbal preparation might have a better outcome in terms of cure, rate of recurrence, and quality of life. The mechanism of action of the mixture was not addressed and the researchers proposed further studies to understand the pharmacokinetic effect of the preparation [1].

Khan and associates, in a systematic review, found four studies analyzing the effect of platelet-rich plasma (PRP) on wound healing after the excision of PNS. They concluded that PRP was superior for wound healing in comparison to the usual daily dressing in secondary healing of PNS wounds as it shortened healing time and hastened early return to work consequently it decreased the overall cost of the treatment of the disease. The investigators could not give an explanation for the mechanism of action of PRP and other pharmacodynamic and pharmacokinetic properties as there were not enough data from the animal house and biochemical laboratories regarding the basic characteristics of the preparation [8].

This finding (nodule and foreign body granuloma) is similar to the scalp PNS in humans that has been reported in the literature [9]. The samples which were taken in the 7th week were completely normal without any sign of granulomas or nodules. This might be explained by the fact that rat is a hairy animal and gained the capacity to get rid of hair problems.

5. Conclusion

Rat is not an ideal animal for induction of PNS. Other hairy animals may behave in the same way. Non-hairy animals might be the best option for the induction of PNS and for studying the effects of various compounds on PNS.

6. Declarations

Conflicts of interest: no conflicts of interest
Ethical approval: Not applicable
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Authors' contributions: UAM, EKM, LMA and FB participated in data collection; SHM designed the study; HA was the pathologist examining the specimen; GSA performed the data analysis; HOA, FHK participated in preparing the manuscript; AMS and HOB; critically revised the manuscript; HMR, BAA confirmed the authenticity of the data; all authors approved the final version of the manuscript.

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