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CASE STUDY: THE EFFECT OF CHITOSAN AND ZINC OXIDE OINTMENT FOR TREATMENT ON HEALING INCISION WOUNDS AFTER PERIANAL URETHROSTOMY SURGERY IN CATS AT THE DR.B SIDOARJO VETERINARY CLINIC

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Abstract: *Incised wound is tissue damage because it is sliced by a sharp and flat instrument such as a scalpel. Treatment of incision wounds is usually conventional, namely Povidone iodine 10% as an antiseptic can be irritating and inhibit granulation, while topical antibiotics can cause resistance if used inappropriately. Chitosan and Zinc oxide are therapies made from natural ingredients that can be used by minimizing side effects while accelerating tissue regeneration. Chitosan and zinc oxide have been shown to be effective in the use of burns in white rats and diabetic wounds in humans. This case study aims to see the effect of giving chitosan ointment and zinc oxide on the healing of incision wounds after perianal uretrostomy surgery in cats. This research method used domestic male cats with a BB of 4 kg who were treated with chitosan ointment and zinc oxide on the suture wound and observed until the 6th day after surgery. The wound healing parameters are seen from the degree of redness, swelling, inflammatory fluid, and the edge of the suture wound. The results showed that the degree of wound redness, swelling, inflammatory fluid, and wound edges occurred faster on the 1st and 3rd days postoperatively and the optimal effect of incision wound healing occurred in 6 days postoperatively without the presence of fibroblast tissue. The conclusion of this study is that chitosan and zinc oxide are able to provide a faster healing effect on cat incision wounds.*

INTRODUCTION

There are two types of wounds, there are open and closed wounds. Closed wounds characterized by internal bleeding and open wounds characterized by lacerations on the skin with external bleeding such as in incision wounds (Fajarningrum, 2022). Incised wound is tissue damage because it is sliced by a sharp and flat instrument such as a scalpel. Incisional wounds can become chronic wounds if not treated immediately because they can be contaminated with bacteria and cause infection, therefore the treatment of incision wounds is very important to carry out (Wilantari, 2019).

Wound healing is a form of business process to repair the damage that occurs. The

main component in the wound healing process is collagen in addition to epithelial cells. Fibroblasts are cells responsible for collagen synthesis. The wound healing phase includes the inflammatory phase, the proliferation phase and the maturation phase (Alsen and Sihombing, 2014).

The treatment of incision wounds that is often used is Povidone iodine 10% as an antiseptic. However, antiseptics themselves can be irritating and toxic if they enter the blood vessels and in excessive use can inhibit the process of wound granulation due to the growth of inhibited fibroblasts so that collagen synthesis also decreases (Prastika et al., 2020). In addition, topical use of antibiotics is often given as conventional therapy for incisions. Inappropriate to long-term use of antibiotics will cause side effects, one of which is antibiotic resistance.

Therefore, another alternative is needed in the form of wound care using natural ingredients. Research on natural ingredients to help the wound healing process has been carried out a lot, one of which is the use of shrimp skin containing chitin compounds (Dompeimpen et al., 2016) which if it undergoes a deacetylation process, chitosan compounds will be obtained (Dayanti et al., 2021).

Chitosan has been researched to be able to spur cell proliferation, increase collagen production and accelerate cell regeneration in injured skin (Dayanti et al., 2021). Chitosan is also able to produce a small number of fibroblasts and produce strong healing because it is able to thicken collagen so that the skin is not easily irritated again.

Zinc Oxide is a chemical or inorganic compound derived from the mineral zinc and in the form of a white powder (insoluble in water) obtained from the oxidation process. This compound is widely used as an additive in various skin care products to sunscreens. In addition, Zinc Oxide is considered to have activities to accelerate wound healing by reducing inflammation in wounds and fighting infection-causing bacteria that can slow down wound healing and are able to stimulate the process of closing wounds with new skin tissue (Widhyari and Wientarsih, 2014). Zinc oxide can also help inhibit the release of excess histamine compounds in the body, preventing allergic reactions (Akbari and Pramuningtyas, 2024).

Both ingredients can be used as a primer and function to maintain moisture in the wound while accelerating tissue regeneration. The wound care method that is developing today is to use the principle of *moisture balance* known as modern wound dressing, which is stated to be more effective in wound healing. *Modern wound dressing* is one of the methods of wound care with a moist method that is focused on keeping the wound from dehydration and improving the wound healing process. Wounds with a humid atmosphere can accelerate fibrinolysis, angiogenesis, reduce the risk of infection, the formation of growth factors, and the formation of active cells (Gito and Rochmawati, 2018). Chitosan and Zinc oxide have been shown to be effective in burning wounds in white rats and diabetic wounds in humans (Lubis et al., 2023; Sukmawati et al., 2022).

The purpose of this study is to determine the potential of Chitosan and Zinc oxide ointment in the healing activity of post-operative incision wounds in cats which has not been previously reported. Previous research reports still used conventional treatment, namely iodine povidone 10% and antibiotics for suture wound therapy (Cakrawati et al. 2021; Nissa et al. 2023). This research is also a consideration in the further development of open wound

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treatment in pets.

RESEARCH METHODS

Tools and Materials

Materials used in this study namely a 3-year-old domestic cat weighing 4.45 KG, physiological NaCl solution, sterile cotton, tetrachlorodecaoxide solution (Oxoferin®, PT Pharos, Jakarta, Indonesia) and topical ointment containing chitosan-zinc oxide (Metcovazin®, PT. BIDARA MEDIKA TREE, Bogor, Indonesia).

Research Methods

This research method is qualitative descriptive in the form of observation of the healing of cat incision wounds given ointment therapy containing chitosan and zinc oxide (Metcovazin®, PT. BIDARA MEDIKA TREE, Bogor, Indonesia). Observation of the wound is carried out every day starting from the first day of the incision until the healing of the incision wound which is calculated in the next few days.

The data collection instrument is in the form of a medical observation sheet to record the time required for the incision wound to heal, as well as the visible wound healing phase, namely the level of redness, swelling, inflammatory fluid, and the edge of the suture wound.

Research Period And Location

The research period was carried out for 6 days postoperatively. The location of the research was carried out at the dr. B Sidoarjo.

Data Analysis

The data analysis in this study is in the form of the process of analyzing, describing and summarizing the events from the data obtained through direct observation of the incision wound.

Case Report

Examination And Therapy

This case report uses a white cat patient, a 3-year-old male domestic cat, weighing 4.45 kg who is a patient after perianal uretrostomy surgery carried out at Dr.B Sidoarjo Veterinary Clinic. The white cat previously came to the clinic with a weak condition, decreased appetite, vomiting water and could not pee for 3 days. When embarrassed by a physical examination, the condition of the bladder enlarged and hardened, the right kidney palpation was slightly swollen, dehydrated, fever with a temperature of 39.5 C and a crooked penis shape was found. In order to consider the diagnosis, an ultrasound examination is carried out and blood samples are taken which are sent to the laboratory for routine hematology and blood chemistry examinations.

Based on the results of the ultrasound examination, the white cat's bladder experienced distension, there was a thickening of the bladder wall with anechoic lumen and there was urolith. In addition, there is a narrowing of the urethral lumen with hyperechoic walls. The catheter installation could not be done due to obstruction of the urethra and aggravated by malformations in the penis, so *perianal uretrostomy* surgery was carried out on the 2nd day of the patient's arrival. The action was carried out to widen the cat's casing channel. Before the surgical procedure, *cytosynthesis* is carried out on the 1st day of the patient's arrival. Cytosynthesis is a procedure for collecting urine by inserting a syringe directly into the bladder in a legeartis manner. The procedure was carried out because the

installation of the catheter tube could not be done due to the blocked catheter tube.

The white cat showed a stable condition on the first day after surgery with a body temperature of 38.5°C and the condition of the stitches that were still wet.

Postoperative care is carried out wound cleaning using sterile gauze, physiological solution NaCl, tetrachlorodecaoxide solution (Oxoferin®, PT Pharos, Jakarta, Indonesia) and topical ointment containing chitosan-zinc oxide (Metcovazin®, PT. BIDARA MEDIKA TREE, Bogor, Indonesia). The treatment given is the antibiotic Amoxicillin- clavunalate acid (Claneksi®, PT. Sanbe farma, Jakarta, Indonesia) with a dose of 13.75 mg/kg 2X1 PO, Anti-inflammatory dexamethasone (Dexamethasone 0.5 mg®, PT. Novapharine, Gresik, Indonesia) with a dose of 0.2 mg/kg, 2x1, PO for 5 days and the installation of Ringer lactat® infusion (PT. Widatra bhakti, Pasuruan, Indonesia) intravenously for 5 days. During the treatment period, the cat is placed in a cage that is kept clean to limit movement and fitted with an elizabeth collar to prevent the cat from biting the stitches.

RESULTS AND DISCUSSION

The white patient was caged and fitted with an elizabeth collar to restrict movement and prevent the cat from biting and licking the stitches. On the 1st day after surgery, the wound was still wet, swollen and red, appetite and drinking were still little, and activity decreased slightly. On the 2nd day, the wound was still watery, reddish and swollen, and the appetite and drinking were still small. On the 3rd day, the wound dried up and was still red, the appetite and drinking were still little, the oral mucosa looked pale, and the urine was normal. On the 4th to 6th day, the wound dries up, does not swell, the base of the wound with the edge of the wound is parallel, no scabs form on the edge of the suture, appetite and drinking begin to improve, body activity begins to increase, urine is normal and defecation is visible. On the 6th day the patient is allowed to go on an outpatient basis. However, on the 7th day, the patient returned to the clinic with an enlarged suture wound and a deeper lumen until the hypodermis was visible, and it was watery.

The wound healing parameters were seen from the level of redness, swelling, inflammatory fluid, and the edge of the suture wound (Putra et al., 2018). This is in accordance with the theory of wound healing, namely the phase of inflammation, proliferation and maturation.

The inflammatory phase is the body's reaction to the wound that begins after a few minutes and lasts for about three days after the injury. The inflammatory phase is characterized by swelling (tumor), pain (dolor), redness (rubor), heat (heat), and impaired function in the inflamed tissue (functiolesa). There are two main processes that occur during this inflammatory phase: hemostatic (controlling bleeding) and epithelialization (forming epithelial cells at the site of injury). Too little inflammation will cause the inflammatory phase to last for a long time and the repair process to be long. Too much inflammation can also prolong the healing period because the cells that arrive at the wound will compete for adequate nutrition (Yenti et al., 2011).

The proliferation phase or *fibroplasia* will occur on the 4th to 7th day which is characterized by granulation, contraction, and epithelialization of the injured tissue. This phase is the phase of filling the wound with new granulated tissue and closing the top of the wound with epithelialization (Cakrawati et al., 2021; Nissa et al., 2023).

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The *remodelling* or maturation phase is the final stage of the wound healing process, which can take a long period of time, depending on the depth and area of the wound. This phase involves the formation of new collagen, strengthening wound tissue, and scar formation. Collagen scar tissue continues to reorganize and will strengthen after a few months. However, wounds that have healed usually do not have the same elasticity as the tissue they replace. (Cakrawati et al., 2021; Nissa et al., 2023).

On the 1st to 3rd day after surgery, redness was seen in the wound due to the formation of new capillaries in the wound area. This is in accordance with the statement of Dewi and Dewi (2024), that chitosan accelerates inflammation and the formation of new capillaries so that it helps the process of cell and tissue regeneration because it can increase blood supply. Blood supply is needed in the active metabolism of cells so as to accelerate tissue regeneration. Naturally, the body can heal on its own, but drug therapy is needed to be able to accelerate wound healing (Sandra, 2023).

In the homeostasis phase, zinc oxide can increase activation and aggregation to respond to damaged blood vessels and form blood books (Pratama et al., 2023). In addition, Chitosan is considered to accelerate inflammation because it has good coagulation properties. Coagulation is the body's natural mechanism to stop bleeding when an incision wound occurs, while the inflammatory phase is the phase after it. Zinc oxide itself can also initiate the inflammatory phase by inducing and carrying a large amount of protein and inflammatory cells to the wound area (Putra et al., 2018).

In this phase, swelling caused by tissue edema also occurs. Damaged cells release chemicals such as bradykinin, histamine and prostaglandins thereby triggering an inflammatory reaction to protect and restore the wound area. This reaction triggers an increase in blood capillary permeability so that the protein-rich fluid in the blood (plasma protein) flows into the interstinal tissue or edema occurs (Zakariya et al., 2009). Swelling did not occur on the 3rd day when compared to other topical wound therapy. This is in accordance with the statement of Dewi and Dewi (2024), that chitosan can accelerate wound healing by increasing inflammatory mediators such as macrophages, fibroblasts, polymorphonuklear leukocytes (PMN) and osteoblasts. Macrophages have the ability to attract fibroblasts to migrate to damaged tissue and subsequently form scar tissue that covers the wound.

Wounds that appear watery are usually blood plasma called serous drainage. This condition is part of the wound healing process and normally occurs in small amounts. . During the first 24 hours, the inflammatory exudate will wet the wound. This then makes a clotting product called serum and fibrin. On the 3rd day, the inflammatory fluid decreases faster. The inflammatory fluid in the wound decreases along with the wound healing process. Wounds that will heal are characterized by several characteristics, such as: Wounds begin to dry, Not watery, Not reddened, Swelling decreases, No pain. On the 3rd day, the wound begins to experience a faster proliferation process. This is certainly in contrast to the statements of Cakrawati (2021) and Nissa (2023) Where it usually occurs on the 4th day.

Little appetite and drinking can be caused by pain that arises during the inflammatory phase. Pain in inflammation or inflammation as a result of chemicals released when inflammation occurs. These chemicals stimulate nerve endings so that the affected area feels more sensitive. In addition, the swelling that occurs can compress the skin tissue or

surrounding tissues, causing pain (Kurniawan et al., 2014).

On the 4th to 6th day, the wound undergoes a proliferation phase where this phase is the phase of filling the wound with new granulating tissue and closing the top of the wound with epithelialization (Figure 1). According to Putra et al. (2018), Chitosan has activity for the initiation of fibroblast cells in the wound area faster. High activation of fibroblast cells will make the re-epithelialization process in the wound area also faster. In addition, Zinc has an important role in protein synthesis and the process of replication of body cells and plays a special role in the metabolism of skin and connective tissue (Zakariya et al., 2009). In the polymerization phase, zinc oxide is required to maintain the stability of the cell wall and promote the polymerization of fibroblasts.

Figure 1. Postoperative wound on day 4.

On the 6th day, the incision wound dries up with the base of the wound and the edges of the wound parallel (Figure 2). This is in line with the research of Putra et al. (2018), where the use of chitosan produces wound conditions that tend to be smoother due to the lack of scar tissue formed. A wound is said to heal if there is a complete re-epithelialization process, which is the process of forming epithelial tissue to cover the entire surface of the wound. However, wounds that have healed usually do not have the same elasticity as the tissue they replace.

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Figure 2. Wound after surgery on day 6.

On the 7th day, the sores become red and watery again with a larger and deeper diameter (Figure 3). This is due to the lack of strict supervision from the owner when he is at home so that the cat can bite the stitches of the wound. However, when he arrived at the clinic, the wound was immediately cleaned again using a physiological Nacl solution and sterile gauze as well as the administration of chitosan and zinc oxide ointment. The wound improved again on the 10th day.

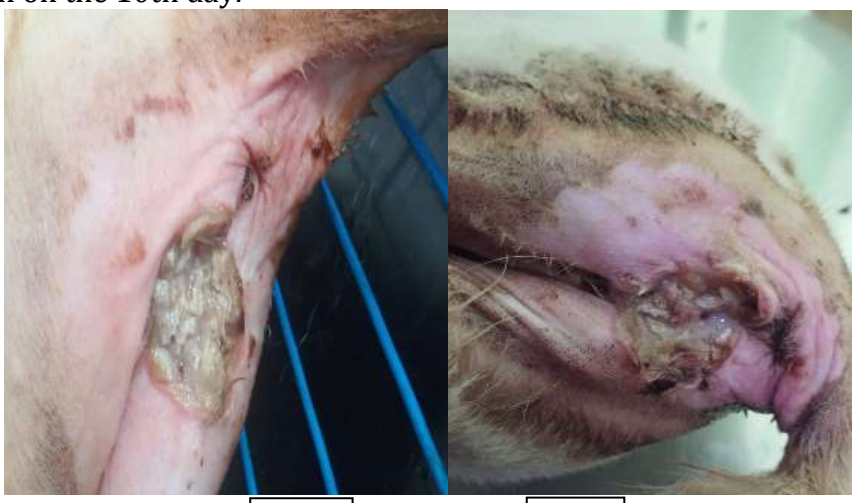

Figure 3. The patient's wound is white after outpatient treatment. A. Before cleaning. B. After cleaning.

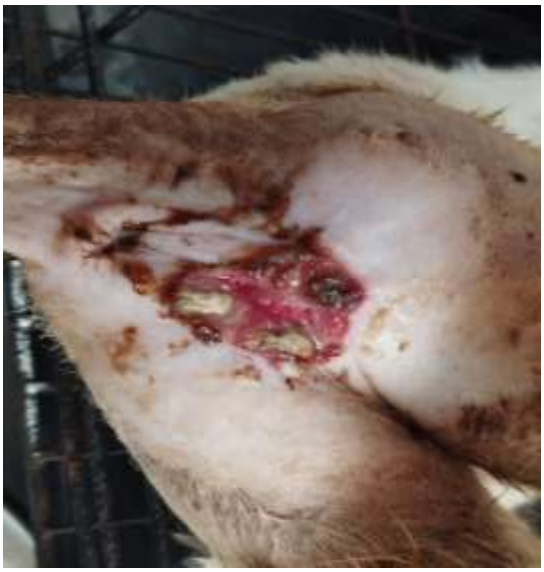

Figure 4. The patient's wound was white on the 10th day.

CONCLUSION

The administration of Chitosan ointment and zinc oxide therapy is able to accelerate wound healing, where on the 3rd day after surgery the wound does not experience swelling and dryness and on the 6th day the wound begins to heal by being marked by thorough epithelialization of the wound. The use of chitosan is able to produce wound conditions that tend to be smoother because of the lack of scar tissue that is formed.

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Author Contributions

Balqis Ria Putri1* as Conceptualization; Methodology; Software; Validation; Formal analysis; Investigation; Resources; Data Curation; Writing - Original Draft and Bilqisthi Ari Putra[2] as Writing - Review & Editing; Visualization; Supervision; Project administration; and Acquisition of funding).

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