THE EFFECT OF HYDROGEN PEROXIDE ON THE HEALING OF THE LAID OPEN WOUND IN THE TREATMENT OF CHRONIC SACROCOCCYGEAL PILONIDAL SINUS: A RETROSPECTIVE DATABASE ANALYSIS OF 500 PATIENTS

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ABSTRACT

Background: Many clinical studies reported excellent results when the lay open the method was used as a treatment of chronic sacrococcygeal pilonidal sinus, despite leaving the wound open for a long time, and the increased risk of infection and recurrence. In our study, we aim to analyze the effectiveness of hydrogen peroxide use in the postoperative care of the laid open sacrococcygeal pilonidal wound in regard to wound infection, complete wound closure, and recurrence.

Methods: Five hundred patients with chronic sacrococcygeal pilonidal sinus were included in our study. 383 were male, and 117 were female (age range, 16–39). Lay open was performed to all patients. Two hundred and fifty patients accepted the protocol of hydrogen peroxide wound care, the other 250 patients preferred normal saline wound care. Postoperative follow-up methods were similar to all patients.

Results: Recurrence rate was 0% after five years of follow-up for the open lay technique in the H2O2 group, and 2% in the normal saline group. Postoperative wound infection rate was 3.2% in the H2O2 group compared to 19.2% in the normal saline group and the average complete wound closure time for the H2O2 group was 21 days, while in the normal saline group was 28 days.

Conclusion: We conclude that when 3% hydrogen peroxide is used for cleaning the laid open wound in treating chronic sacrococcygeal pilonidal sinus, with good postoperative care and regular follow-up is effective in helping to achieve a zero (0%) recurrence rate, low wound infection rate, and short complete wound closure time.

KEYWORDS lay open, wound infection, sacrococcygeal pilonidal sinus, hydrogen peroxide, normal saline

Introduction

Pilonidal disease is an infection in a “ditch” that results from the mechanical stretch, which causes enlargement and rupture of hair follicles in the natal cleft. The disease is confined to skin...
and fat, can be acute or chronic, minor or major, and can range from an asymptomatic pinhole in the skin to an abscess the size of an orange. The disease affects mainly young men aged 15-30 [1]. It limits the patient’s lifestyle and results in loss of productive power [2].

For treatment, various noninvasive [3] and surgical methods (simple incision and drainage, lying open, marsupialization, excision and primary closure, or rhomboid excision and Limberg flap) have been performed [4-6]. Despite these methods, the disease often leads to postoperative complications and recurrence.

Male gender, obesity, smoking, a family tendency, poor body hygiene, sinus size, and the surgical procedures performed have been confirmed in some studies as primary risk factors for postoperative complications and recurrence [7-11]. Complicated pilonidal surgical wounds are associated with considerable morbidity, including chronic sacral wound, loss of work time, and lifestyle limitation [11].

Wound infection is one of the causes of recurrence and primary closure failure. Culture of infected wounds demonstrates mostly endogenous colonic flora as accusing agents [12]. A three-percent solution of hydrogen peroxide is commonly used as a wound antiseptic, and although it is very commonly used, surprisingly few studies have been conducted to examine its effect on the wound healing process and its efficacy as a wound antiseptic [13].

Our 15 years experience in performing lay open to chronic sacrococcygeal pilonidal sinus in our local community leads to the observation that personal hygiene status, postoperative wound care compliance, and daily wound cleaning using only normal saline contributed to an increased rate of wound infection, delayed wound healing, and recurrence.

In Saudi Arabia where the religious Islamic five time prayers during the day and night necessitate complete cleanliness and are preceded by ablution (the Islamic procedure for washing parts of the body using water, typically in preparation for formal prayers), encounter a great deal of concern to patients suffering from anorectal and urological diseases. The reputation that surgical management in general, and lay open in particular, of the chronic sacrococcygeal pilonidal sinus with the resultant dirty - bleeding wound makes the lay open surgical option a very annoying option to most patients.

Therefore, any postoperative wound care method to treat the lay open wound which provides clean and dry body all the time means a lot to that group of patients. As a The consequence, we experienced refusal of surgical treatment of many patients and increase use of traditional herbal methods popular in our local community, which necessitated the need for an effective wound care protocol for those group of patients.

In this study, we aim to analyze the effectiveness of hydrogen peroxide use in the postoperative care of the laid open sacrococcygeal pilonidal wound regarding wound infection, complete wound closure time, recurrence, and the impact on the social and religious life of our population study group.

Materials & Methods
As part of the quality assurance program to evaluate the medical service provided to our patients, a retrospective database analysis of the results of the first consecutive 500 patients who had the lay open procedure for the treatment of chronic pilonidal sinus between January 2001 and December 2010 was done. The preoperative workup, selection of patients, surgical procedures, and follow-up were carried out by the same surgeon, in Al-Ansar public health general hospital in Medina, Saudi Arabia.

The patients were selected from the outpatient clinic, and all presented with a chronic disease. Patients who presented to the emergency department with an acute form were excluded because they were treated by the on-call surgical team. Random selection (no exclusion criteria) regarding age, gender, and social status was done.

All patients had the same preoperative workup (complete blood count - coagulation profile - blood chemistry - chest x-ray - electrocardiogram)

The procedure and postoperative care were carefully discussed with all patients, and they were given the option to choose between H2O2 or normal saline method. The patients were admitted to the surgical floor one day before surgery, and discharged on the first postoperative day. No antibiotics were used at any stage of the treatment and follow-up.

The lay open procedure was done under general anesthesia, prone position, the visibility of the intergluteal area was maintained by lateral traction from the lateral margin of the gluteus, using adhesive tape, probe insertion through the external opening of the sinus to map the tract, lay open using cutting diathermy, removal of hair tufts and debris from the wound, curettage of the wound wall by surgical curette to remove any remnants of the sinus sac and establishing a healthy tissue for healing, haemostasis was secured by coagulation diathermy, the wound was cleaned with normal saline, packed with vaseline gauze, and covered with surgical gauze.

Postoperative care for the lay open patients who accepted normal saline method consisted of daily dressing in the hospital outpatient dressing room using 9% normal saline, and wound packing by vaseline gauze to keep the wound open and help the growth of healthy tissue from below upward, and wound coverage by surgical gauze. For the patients who accepted H2O2 method, daily wound dressing in the hospital outpatient dressing room was done, using 3% H2O2 solution for 2 minutes, then washing the wound by normal saline, wound packing by vaseline gauze to keep the wound open, and wound coverage by surgical gauze.

Follow-up was done in the outpatient clinic once every week until the complete closure of the wound. All patients were then seen once every three months for one year to evaluate for recurrence, then once every year for four years, and all the patients were given an open appointment whenever recurrence occurs.

Retrospective database analysis was done regarding symptoms, duration of the disease, the length of postoperative care until complete healing, quality of life postoperative (pain and discomfort, complications like bleeding or pus discharge), return to work or school, the effect on social activity, complications, and recurrence of the disease.

Results
Between 2001 and 2010, 500 patients were diagnosed to have chronic sacrococcygeal pilonidal sinus in the outpatient clinics, 317 (63.4%) were from Medina city, and 183 (36.6%) were referred from towns, villages, and rural areas of Al Madina Al Monawarah region.

Five hundred (100%) patients agreed to be treated by the open lay technique. The first consecutive 250 patients (50%) who accepted the new protocol of 3% H2O2 wound care were selected, while the other 250 (50%) consecutive patients who
were reluctant to try the new method and preferred the routine surgical wound cleaning by 9% normal saline were included in the control group.

The patients were 383 male (76.6%) and 117 female (23.4%), the age range was 16–39 years (median 26.5), 368 (73.6%) were between 20 and 30 years, 95 (19%) were between 31 and 40 years (the oldest was 38).

Symptoms in all patients were reported as pain alone in the sacrococcygeal area in 62 (12.4%) patients, pain and bloody discharge in 173 (34.6%), pain and pus discharge in 194 (38.8%), painless discharge – blood or pus – in 71 (14.2%). No co-morbid conditions were recorded in all the study population.

Disease duration was more than one month in 223 (44.6%) patients, more than three months in 146 (29.2%), more than six months in 131 (26.2%).(Figure 1)

The average complete wound closure time for the H2O2 group was 24 days while in the normal saline group was 32 days.(Figure 2)

In regard to the effect on quality of life, surprisingly, patients who elected H2O2 reported no postoperative pain at all, while 127 (50.8%) of the patients who had normal saline cleaning complained of postoperative pain for more than 1 week and required analgesia, while 123 (49.2%) complained of discomfort only not requiring analgesia.

Concerning time to report to work, no difference was found between the two groups, 247 (49.4%) patients reported to work and school within one week and had no side effect, 221 (44.2%) waited till complete healing, and 32 (6.4%) had no work or school to attend.

No difference was found between the two groups regarding the effect on social activities, 364 (72.8%) patients reported no impact on social activity (personal daily activity, sport, social gathering, and religious deeds), while 136 (27.2%) reported mild limitation of their activity.

Postoperative complications showed that postoperative wound infection rate was 3.2% in the H2O2 group compared to 19.2% in the normal saline group (whitish - greenish discharge for 2-4 days). All patients were from the rural areas and had a low hygienic personal habits. In all patients, no change in wound cleaning method was needed, and no antibiotics were used, only personal hygiene modification was advised. In the end, all wounds closed nicely and completely. Right superficial healed wounds without scarring were observed in all patients.

The recurrence rate was zero (0%) after five years follow-up for the open lay technique in all 250 patients in the H2O2 group, and (2%) in the normal saline group, all were from the rural areas, they were retreated by the same method and eventually achieved complete wound closure.(Figure 3)

All patients completed five years follow-up, no drop out was recorded.

**Discussion**

Sacrococcygeal pilonidal sinus is an important disease that seems simple but leads to high rates of postoperative complication and recurrence. However, there is not a consensus on the ideal treatment type for sacrococcygeal pilonidal sinus despite many alternatives. It has a high incidence rate of 26 to 700 of 100,000 people. It is prevalent in male subjects between the ages of 20 and 25 years [14]. The disease was seen 4.1 to 8.1 times more in males than in female [15,16].

In the etiology, pilonidal sinus disease was previously believed to result from postcoccygeal cells or remnant glands, whereas acquired factors are considered to play the greatest part today. Karydakis attributed the hair insertion process to 3 main factors: the invader, the force that causes the insertion, and the vulnerability of the skin to the insertion of hair at the depth of the natal cleft [9].The family tendency is also an im-
within that cleft inhibit epidermal closure and are the reason for the failure to heal [26]. Smoking leads to hypoxia development in peripheral structures, causing the proliferation of bacteria in the wound area. It also triggers separation in the wound area, reducing the restraining capacity of sutures while promoting the impairment of collagen synthesis. Further, it weakens oxidative killing by neutrophils [11,12]. In our study, 307 (61.4%) patients were smokers.

It was thought that most causes of pilonidal recurrence are related to the remnant of sinus tract after surgery; but currently, this idea is changed, and now it is believed that recurrence is related to the acquisition of new disease rather than persistence of an old tract [21]. Traditionally, the role of hair for pilonidal disease and recurrence has been always proposed in the pilonidal related literature. Some studies proposed laser depilation following pilonidal surgery or simultaneously during pilonidal surgery for patients with recurrent pilonidal disease [22-24]. However, razor epilation is associated with increased rate of recurrence, shown in a German study of approximately 11 years of follow-up [25].

The most common cause of persistent open wounds after surgery for the pilonidal disease is the deep cleft and the moist, bacterial laden, anaerobic conditions that arrest healing. The mystery of unhealed pilonidal disease is solved by understanding that the shape of the cleft and the conditions generated within that cleft inhibit epidermal closure and are the reason for the failure to heal [26].

Using electrocautery during operation is discouraged and is associated with higher incidence of wound infection and dehiscence, hematoma formation and prolonged healing time, compared with tissue sealing cutting devices [27]. However, a prospective randomized trial that compared using monopolar diathermy excision with knife excision report lower operation time and patient postoperative pain in diathermy group and no difference in wound healing time between groups, but the rate of recurrence was not investigated in this study [28]. The risk of recurrence is decreased significantly by a combination of using preoperative antibiotics, excision with a scalpel and early removal of tie dressing in contrast with not using preoperative antibiotic, excision with electrocautery and removal of tie dressing after seven days [29]. In our study, the careful use of cutting electrocautery for the incision, and coagulation electrocautery for hemostasis did not affect the procedure or the outcome.

Applying subcutaneous sutures to approximate deep tissues did not reduce wound complications for the simple primary closure of pilonidal wounds [30]; as using drain after excision with primary closure seemed to reduce infection and recurrence but these results were not statistically significant [31].

Currently, there are no randomized controlled trials that compare using antibiotics versus placebo for surgical site infection, but a systematic review of literature demonstrated that prophylactic use of antibiotics does not alter surgical site infection, healing or recurrence rate. Comparison of short term and long term antibiotic therapy also did not show any difference; even using gentamicin collagen sponge did not show any improvement [32]. No antibiotics were used in our study for any patient at any stage.

Developing postoperative infection and presence of secondary sinus are also risk factors for recurrence [33]. During 15 years experience in managing pilonidal sinus disease in our local community, we observed that wound infection was the primary cause of recurrence, regardless of using normal saline or iodine povidone for wound cleaning, and that was the reason behind the hydrogen peroxide protocol in this study.

A 3% solution of hydrogen peroxide is a commonly used wound antiseptic [34]. However, few studies report on its efficacy in wound healing and as an antiseptic, and its use remains controversial. While some studies have shown hydrogen peroxide to be cytotoxic to healthy cells and granulating tissues, other animal, and human studies have shown no effect on wound healing [35,36]. Several studies have also shown hydrogen peroxide to be ineffective in reducing bacterial count [36]. The American Medical Association summarized that the effervescing cleansing action of hydrogen peroxide might act as a chemical debriding agent to help lift debris and necrotic tissue from the wound surface when used at full strength [37]. If used, irrigation with normal saline after full-strength hydrogen peroxide use is recommended.

Hydrogen peroxide was first used as a disinfectant by an English physician in 1858 and was marketed under the name Sanitas. The 3% solution was popular for use on wounds from about 1920 to 1950. Hydrogen peroxide kills bacteria by decomposing to hydroxy radicals. It is produced by living cells to protect the body from harm caused by bacteria [38].

A study with Escherichia coli exposed to a constantly replenished stream of hydrogen peroxide showed that bacterial growth was inhibited by 0.02-0.05 mmol/l hydrogen peroxide, a concentration that was not damaging to fibroblasts from human skin [39].

In our study, we observed in all 250 patients that when H2O2 was applied to fresh wounds, brownish bubbles resulted, then gradually fade to whitish day by day, and after 2 weeks, bubbling stopped, and the solution was clear and colorless during the 2 minutes, we attributed that as a sign of the degree of the wound cleanliness, or fading of infectivity. When hydrogen peroxide solution is used for the dressing of gaped wounds, the release of nascent oxygen from hydrogen peroxide oxidizes the debris, and the effervescence pushes it from the depth of the wound [40].

We also observed that the appearance of healthy granulation tissue was faster in the H2O2 patients than the normal saline patients, and might positively contribute to the faster and shorter healing time in the H2O2 patients. It takes around one week for hydrogen peroxide to prepare a healthy wound bed [40].

Despite the reputation that H2O2 might lead to the formation of the bad scar when used for wound dressing, our study showed no adverse effect at all. All wounds treated by H2O2
We conclude that when 3% hydrogen peroxide is used for clean- ing the laid open wound in treating chronic sacrococcygeal pilo- nidal sinus, with good postoperative care, and regular follow- up, is effective in helping to achieve a zero (0%) recurrence rate, low wound infection rate, and short healing time without local or systemic adverse effects.

Given the results of our study, we believe that a more detailed scientific prospective studies should investigate the role of hy- drogen peroxide in postoperative care of the laid open wound of pilonidal sinus disease, especially in communities were wound infection is a major occurrence.

Conclusion
We conclude that when 3% hydrogen peroxide is used for cleaning the laid open wound in treating chronic sacrococcygeal pilonidal sinus, with good postoperative care, and regular follow-up, is effective in helping to achieve a zero (0%) recurrence rate, low wound infection rate, and short healing time without local or systemic adverse effects.

Authors’ Statements
Competing Interests

The authors declare no conflict of interest.

References


