

Comparison of Autolytic Debridement Treatment Using Hydrogel and Silver Sulfadiazine Cream Combined With Hyaluronic Acid in Pressure Ulcer Patients with COVID-19 at Dr. Soetomo Hospital

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Abstract

Pressure ulcer is a lesion obtained due to pressure on the body area with bone protrusion. Prolonged pressure on the surface area of the protruding bone may result in localized soft tissue damage. This study was conducted to compare autolytic debridement treatment using hydrogel and silver sulfadiazine-hyaluronic acid cream in pressure ulcer patients with COVID-19 at Dr. Soetomo Hospital. The aim of this study is to analyze autolytic debridement treatment using hydrogel compared to silver sulfadiazine - hyaluronic acid cream in pressure ulcer patients with COVID-19 at RSUD Dr. Soetomo. This study is a retrospective study with an observational analytic design with the source of research data using secondary data by looking at research variables recorded in the medical records at Dr. Soetomo Surabaya Hospital for the period April 2020 - March 2021. Research subjects were selected using the total sampling method that met the inclusion and exclusion criteria. The data obtained will be assessed using the perdanakusuma score II before treatment and 4 weeks after treatment. The number of research samples was 28 patients with 18 patients treated using hydrogel and 5 patients treated with silver sulfadiazine - hyaluronic acid cream. There was a significant decrease in perdanakusuma score II after wound treatment using hydrogel and silver sulfadiazine - hyaluronic acid cream in pressure ulcer patients with COVID-19 at Dr. Soetomo Hospital. There is no significant difference between treatment using hydrogel compared to silver sulfadiazine - hyaluronic acid cream in pressure ulcer patients with COVID-19 at RSUD Dr. Soetomo.

Keywords: Hydrogel; Silver Sulfadiazine - Hyaluronic Acid; pressure ulcer; COVID-19

1. Introduction

Wound is anatomical damage and discontinuity of a tissue due to external trauma (Marzoeki, 2018). Pressure ulcer is a lesion caused by prolonged pressure on areas of the body with bony protrusions that cause tissue necrosis (Tanaka et al., 2020). An estimated 2.5 million cases of pressure ulcers occur each year in the United States (Cavaliere and Aliotta, 2020). There is no definitive data on the incidence of pressure ulcers in Indonesia. A study conducted on 1132 patients in 4 hospitals in Indonesia reported an incidence of pressure ulcers of 8% with incidence before hospitalization in 44% of patients. The total number of pressure ulcers in these patients was 142 with 42% of them categorized in degrees 3 and 4 with the most frequent locations in the sacrum, buttocks and heel areas (Amir et al., 2016).

The physiological response of wound healing can be divided into inflammatory phase, proliferation phase, and maturation or remodelling phase (Saputro, 2014). General management of pressure ulcers includes removing the cause or pressure, systemic treatments such as medication and nutrition, a multidisciplinary approach, and wound care (Zarasade, 2018). This can be done with modern treatments according to the wound condition, including management of non-vital tissue using five debridement techniques, bacterial control, and exudate management. The five debridement techniques that can be used are surgical, mechanical, autolytic, enzymatic, and biological (Perdanakusuma, 2017). The debridement technique that can be chosen for patients for whom surgical debridement is not possible is autolytic debridement. Hydrogel and silver sulfadiazine-hyaluronic acid are autolytic debridements that have been shown to be effective in chronic wound care (Finnegan & Percival, 2015). Hydrogel also showed better results than traditional wound care with wet to dry dressings in cases of chronic wounds after surgery. Pain was also minimal in patients treated with hydrogel (Rezvani et al., 2019). The silver sulfadiazine - hyaluronic acid combination promotes effective wound healing through several mechanisms that occur simultaneously. Hyaluronic acid (HA) promotes granulation tissue formation, protects tissue from bacterial biofilms, and accelerates tissue growth around the wound. Meanwhile, silver sulfadiazine inhibits the growth and infection rate of bacteria in the wound. The combination of bacterial management mechanisms and wound bed preparation of the two ingredients is strongly associated with skin repair and the wound closure process (De Fransesco, et al, 2022).

Coronavirus is a virus that causes respiratory infectious diseases, such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). A new type of coronavirus discovered in humans since an extraordinary event appeared in Wuhan China, in December 2019, was later named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV2), and causes Coronavirus Disease-2019 or commonly referred as COVID-19 (Wu, 2020). The pathophysiology of COVID-19 is related to the etiology of pressure ulcers both vascularly and locally. In particular, cytokine storms, metabolic acidosis, and micro-thrombosis in COVID-19 affect the severity of pressure ulcers (Gefen and Ousey, 2020). The therapeutic management currently used at Dr. Soetomo Hospital still varies with modern wound care techniques. However, there is still no evaluation of the effectiveness of the two types of modern wound care and analysis of influencing factors, especially in patients with confirmed COVID-19. The researcher wants to examine the Comparison of Autolytic Debridement Treatment Using Hydrogel and Silver Sulfadiazine Cream - Hyaluronic Acid in Pressure Ulcer Patients with COVID-19 at Dr. Soetomo Hospital.

2. Method

The type of research used in this study is an analytic descriptive design. The cross-sectional approach in this study is to determine the effectiveness of modern wound care in pressure ulcer patients with COVID-19 at Dr. Soetomo Hospital. Wound assessment is carried out using the Perdanakusuma score II based on the problems found in the wound which include color, inflammatory symptoms, and exudate (Table 1). Each parameter has its own score, and the results are summed up with the lowest score of 3 to the highest score of 16. The lower the score, the better the quality of the wound. The scoring criteria are divided into four. A score of 10-16 is considered severe, 8-9 moderate, 5-7 mild, and a score of 3-4 can be said to be healed (Perdanakusuma, 2021). This study is an analytic descriptive retrospective study with the source of research data using secondary data by looking at research variables recorded in the medical records at Dr. Soetomo Hospital Surabaya. The study sample was all inpatients treated by the Reconstructive and Aesthetic Plastic Surgery Department with pressure ulcers that were confirmed positive for COVID-19 and wound care was performed. Samples were taken by total sampling that met the criteria and had clear and complete medical record data at RSUD Dr. Soetomo Surabaya. This research was conducted in April 2020 - March 2021 at

RSUD Dr. Soetomo Surabaya.

Table 1. Perdanakusuma score II

Indicator		Description	Score
Color	Black	Necrotic	7
	Black – yellow	Necrotic with slough	6
	Yellow	Slough	5
	Yellow –red	Slough with granulation	4
	Red	Granulation	3
	Red – pink	Granulation with epitel	2
	Pink	Epitel	1
Inflammatory response	Large or pus	Noticeable swelling and redness that is widespread around the wound or pus is collected from the wound	4
	Moderate	Swelling and redness is not very extensive and is not evenly distributed around the wound	3
	Mild	Limited redness at the wound edges	2
	None	No visible redness of the skin around the wound	1
Exudate	Lots of exudate	Wetness all over the wound and surrounding area; saturated and wet dressin cannot accommodate and less durable	5
	Ample	Visible wetness on the wound bed; wet dressing can still accommodate	4
	Slight	Appears slightly wet with light reflection; slightly wet dressing	3
	Dry	Dry wound surface	2
	Moist	Moist	1

The collected data were analyzed using descriptive analysis and statistical analysis in the form of the Wilcoxon test to see differences before and after treatment in both groups. Furthermore, statistical analysis was carried out to see differences in the healing of pressure ulcer patients with COVID-19 at Dr. Soetomo Hospital - SMF Reconstructive and Aesthetic Plastic Surgery after being given hydrogel therapy compared to silver sulfadiazine - hyaluronic acid using the T - independent test.

3. Results

The sample of this study was taken by total sampling and adjusted to the inclusion criteria, so that 28 pressure ulcer patients with COVID-19 were obtained at Dr. Soetomo Hospital - SMF Reconstructive and Aesthetic Plastic Surgery.

Table 2. Data characteristics of research subjects

Variable	Total = 28	n hydrogel = 23	ha = 5
Age			
16-60 years	15	15	-
>60 years	13	8	5
Gender			
Male	10	7	3
Female	18	16	2

Variable	Total = 28	n hydrogel = 23	ha = 5
Pressure ulcer location			
Sacrum	23	18	5
Gluteus	5	5	-
Comorbidities			
Hypertension	6	6	-
Diabetes mellitus	12	9	3
Cerebrovascular accident	5	3	2
Infection and congenital	1	1	-
Acute Kidney Injury (AKI)	4	4	-
Pressure ulcer stadium			
Stadium 1	-	-	-
Stadium 2	1	1	-
Stadium 3	18	15	3
Stadium 4	9	7	2
Perdanakusuma score II			
Severe (10 – 16)	24	19	5
Moderate (8 – 9)	4	4	-
Mild (5 – 7)	-	-	-
Healed (3 – 4)	-	-	-

The number of samples in this study were 28 pressure ulcer patients with COVID-19. The patient age variable is divided into two groups where there are 53.6% (n=15) in the age group 16-60 years and 46.4% (n=13) in the age group over 60 years. Overall, patients consisted of male 35.7% (n=10) and women 64.3% (n=18). Based on the location of the pressure ulcer, 82.1% (n=23) were found at the sacrum location and 17.9% (n=5) at the gluteus location. Based on comorbidities, 21.4% (n=6) patients with hypertension, 42.9% (n=12) patients with diabetes mellitus, 17.9% (n=5) patients with cerebrovascular accident, 3.6% (n=1) patients with infection or congenital disease, and 14.3% (n=4) patients with Acute Kidney Injury (AKI). Based on the pressure ulcer stadium, 3.6% (n=1) were stadium 2, 64.3% (n=18) were stadium 3, and 32.1% (n=9) were stadium 4.

Table 3. Wilcoxon test for each group

Group	n	Median (Min – Max)	p-value
Hydrogel Pre	23	11 (8-14)	0,001
Hydrogel Post		10 (7-12)	
Silver sulfadiazine – hyaluronic acid Pre	5	11 (10-12)	0,046
Silver sulfadiazine – hyaluronic acid Post		9 (8-12)	

Furthermore, to determine the differences before and after therapy in each group, the Wilcoxon test was performed. In the hydrogel group, the p value = 0.001 was obtained so that there was a significant difference in the Perdanakusuma score II before and after hydrogel administration. In the silver sulfadiazine-hyaluronic acid group, the p value = 0.046 was obtained so that there was a significant difference in the Perdanakusuma score II before and after the administration of silver sulfadiazine-hyaluronic acid (Table 3).

Table 4. Test between groups

Group	Mean ± SD	p-value
Hydrogel Post	9,96 ± 1,397	0,614*
Silver sulfadiazine – hyaluronic acid Post	9,96 ± 1,517	

Furthermore, to determine the difference between hydrogel and silver sulfadiazine-hyaluronic acid groups after therapy, an independent T test was conducted. The p value=0.614 was obtained so that there was no significant difference in the Perdanakusuma score II between the two groups (Table 4).

4. Discussion

The variation in the Perdanakusuma score II in the hydrogel group varied from moderate to severe. Whereas in the silver sulfadiazine - hyaluronic acid group there was a moderate to severe variation in Perdanakusuma score II.

Hydrogel is one of the autolytic debridement techniques with more than 30% consist of water. The mechanism of this technique is to cause swelling of the necrotic tissue and fibrin layer due to its highwater content. This releases necrose tissue from the wound bed and facilitates water evaporation and oxygen transmission to the wound surface (Wang and Heilshorn, 2015). Hydrogel also increases fibroblast proliferation and stimulates collagen secretion through transforming growth factor beta-1 (TGF- β 1) which in turn accelerates granulation tissue formation and collagen fiber synthesis. Neovascularization can be accelerated by hydrogel through basic fibroblast growth factor (bFGF) secretion and reducing pro-inflammatory macrophages (M1) which will stimulate migration and proliferation of vascular endothelial cells (Chen et al., 2015). This study proves that there is a significant decrease in Perdanakusuma score II in the group using hydrogel therapy.

Silver sulfadiazine has a bacteriostatic effect by acting on the endocellular and cell membrane of microorganisms (Ueda et al., 2020). Silver sulfadiazine will release ions that increase the bacteriostatic effect which will reduce the level of bacterial colonization and prevent secondary infection in the wound (Banerjee et al., 2019). Hyaluronic acid (HA) is part of the intercellular matrix network that induces the release of TNF- α , IL-1 β , and IL8 (Tavianatou et al., 2019). The secretion of these inflammatory cytokines will attract leukocytes, monocytes, and neutrophil cells involved in debris phagocytosis and dead tissue removal (Westman et al., 2020). HA can trigger macrophage responses and induce neoangiogenesis in wounds. HA also stimulates fibrin development, phagocyte mobility, neutrophil and macrophage granulocyte activity, and increases the release of chemotaxis factors to attract fibroblasts (Corrêa et al., 2020). This study proves that there is a significant decrease in Perdanakusuma score II in the group using hydrogel therapy.

In the test of differences between groups, the results were not significant. This shows that both have the same therapeutic potential. Silver sulfadiazine - hyaluronic acid therapy can be used as a substitute for hydrogel therapy with consideration of the bacteriostatic effect of silver sulfadiazine which will reduce the level of colonization and bacterial growth, and prevent secondary infection in the wound. Hyaluronic acid can accelerate the formation of granulation tissue, protect tissue from bacterial biofilms, maintain moisture by binding water molecules, and accelerate wound healing.

In this study, there were limitations, the number of subjects who received silver sulfadiazine - hyaluronic acid therapy was still small. Further research with a larger sample size and periodic evaluation is needed to obtain the efficacy and effectiveness of silver sulfadiazine - hyaluronic acid therapy. This study is an analytical observational study that only assesses based on secondary data. So that recommendations for further research require prospective or cohort methods so that they can be evaluated on an ongoing basis and determine the prognosis of therapy.

5. Conclusions

There is a significant decrease in Perdanakusuma score II after autolytic debridement wound care using hydrogel in pressure ulcer patients with COVID-19 at RSUD Dr. Soetomo. There is a significant decrease in Perdanakusuma score II after autolytic debridement wound care using silver sulfadiazine - hyaluronic acid cream in pressure ulcer patients with COVID-19 at Dr. Soetomo Hospital. There is no significant difference between autolytic debridement treatment using hydrogel compared to silver sulfadiazine - hyaluronic acid cream in pressure ulcer patients with COVID-19 at RSUD Dr. Soetomo. This study is expected to provide further reference in the guidelines for the management of autolytic debridement wound care in pressure ulcer patients with COVID-19 at RSUD Dr. Soetomo.

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