

ARTICLE INFORMATION

Received: January, 20, 2023

Revised: March, 21, 2023

Available online: March, 29, 2023

at : <http://ejournalmalahayati.ac.id/index.php/nursing/index>

Developing integrated care: Treating foot wounds in people with diabetes mellitus exposed by Covid-19

Suyanto, Sri Lestari Dwi Astuti*

Jurusan Keperawatan Politeknik Kesehatan Kemenkes Surakarta
Corresponding author. *E-mail: asri17894@gmail.com

Abstract

Background: Diabetes mellitus is a chronic disease that affects many people around the world. WHO predicts the prevalence in 2030 will increase to 61 percent and it is estimated that 70 percent will become a pandemic in developing countries including Indonesia. Various complications require long-term care and require regular monitoring. One of the complications that is often experienced is diabetic foot ulcers which have increased in cases during the Covid-19 pandemic so that they require optimal service.

Purpose: Developing a nursing service model for type 2 diabetes mellitus (DM) patients, especially the treatment of diabetic foot wounds associated with the covid-19 pandemic.

Method: Research design using *quasi experiment* with a plan *pre and posttest without control group design*, namely comparing the condition of the wound, the effectiveness of the length of time for healing based on the frequency of wound care between 26 respondents who were exposed to covid-19 and 34 respondents who were not exposed. Data analysis used the chi square test.

Results: There is a difference in healing based on the frequency of treating diabetic foot wounds between those exposed to covid-19 and not exposed to obtain a p-value of $0.013 < 0.05$. There is a difference in healing based on the frequency of treating diabetic foot wounds in patients exposed to covid-19 between those who have arterial injuries and those who do not have arterial injuries, obtained a p-value of $0.049 < 0.05$. Then there are differences in the condition of leg injuries before and after being treated in patients who are not exposed to covid-19, obtained a p-value of $0.00 < 0.05$. Whereas in patients exposed to covid-19 there was no difference with a p-value of $0.160 > 0.05$.

Conclusion: All hypotheses proposed except for the hypothesis that there is a difference in the condition of the wound between those exposed to covid-19 and those who were not exposed before and after being given treatment.

Suggestion: In providing wound care to diabetic patients, it should be start by reviewing their history of having been expose to covid-19. Furthermore, an assessment is made of whether the patient has an arterial wound so that the wound care that will be given is more appropriate and effective.

Keywords: Developing integrated care; Treating; Foot wounds; Diabetes mellitus; Covid-19

INTRODUCTION

Diabetes mellitus (DM) or diabetes is a chronic disease that affects many people around the world. Lifestyle changes are one of the causes of DM disease. DM sufferers tend to increase every year, even WHO predicts that in 2030 it will increase to 61%

and it is estimated that in the 21st century it will become a pandemic and 70% will occur in developing countries including Indonesia (World Health Organization, 2016).

Diabetes mellitus type 2 according to the IDF

(International Diabetes Federation) reports that the prevalence rate in 2021 is 10.5% to 12.2% in 2045. It is also reported that the prevalence of T2DM in urban areas is 12.1% higher than in urban areas, rural areas by 8.3% (International Diabetes Federation, 2019; International Diabetes Federation, 2021; Sun, Saeedi, Karuranga, Pinkepank, Ogurtsova, Duncan, & Magliano, 2022).

DM with various complications requires long-term care and requires regular monitoring, causing bio psychosocial and spiritual changes. Spiritual well-being needs to be given so that sufferers feel happy and feel useful in his life even though he is sick. One of the most common complications is diabetic foot ulcers, this occurs due to poor blood sugar control. Worsening condition of foot injuries will occur if blood sugar control is poor and individual patients are not compliant in performing foot care. Leg injuries occur due to nerve death in the feet so that the patient does not feel pain. Because they don't feel pain, they often don't realize they have a wound. Usually they only realize it when they have an infection. Foot wounds need regular care, because wound healing takes a long time. Various foot wound care techniques are currently needed to help heal diabetic foot wounds so that complications do not occur which lead to amputation (Tewahido, & Berhane, 2017; Syafril, 2018; Prabawati, Sari, & Neonbeni, 2021).

Continuous and proper treatment of foot wounds needs to be done so that the foot wound does not expand and complications do not occur which can result in an amputation. Treatment of foot wounds can be done using various dressings with modern

techniques. The use of modern dressings aims to maintain the isolation of the wound environment which remains moist by using moisture retaining, occlusive and semi-occlusive dressings.

RESEARCH METHOD

This type of research is *quasi experiment* with a plan *pre and posttest without control group design*. It will be held from February 2022 to November 2022 at the Wound Care Clinic of the PT Indonesian Nursing Home Unit in Surakarta, Karang Anyar and Sukoharjo, Central Java and the Sleman and Bantul Units, Yogyakarta.

The research sample consisted of 60 people who were given treatment in the form of wound care according to the condition of the color of the wound using the principle *moisture balance* known as the method *modern dressing* until granulation appears. Principle *moisture balance* is to prevent the wound from becoming dry and hard, increase the rate of epithelialization, prevent the formation of scar tissue, increase the formation of dermal tissue, control inflammation and provide a more cosmetic appearance, accelerate the process of autolysis debridement, can reduce the incidence of infection, *cost effective*, can maintain *voltage gradient* normal, maintain neutrophil activity, reduce pain, provide psychological advantage, and easy to use. Furthermore, an evaluation of the effectiveness of the wound care technique was carried out. Analysis of the results of wound care data using chi square analysis.

Suyanto, Sri Lestari Dwi Astuti*

Jurusan Keperawatan Politeknik Kesehatan Kemenkes Surakarta
Corresponding author. *E-mail: asrii7894@gmail.com

DOI: <https://doi.org/10.33024/minh.v6i1.9044>

RESULTS**Table. Demographic and Clinical Characteristic of Patients with Diabetes Mellitus (DM) (N=60)**

Variables		Have been exposed to Covid-19 (n=26)	Have not been exposed to Covid-19 (n=34)	OR 95% CI	p-value
Age					
	Adult	3 (12%)	2 (6 %)		
	Pre-elderly	12 (46%)	18 (53%)		
	Elderly	11 (42%)	14 (41 %)		
Gender					
	Male	11 (42%)	18 (53%)		
	Female	15 (58%)	16 (47%)		
The Tissue Types and Wound Healing Identification by Colour (Before treatment)					
	Black	7 (27%)	6 (18%)		
	Yellow	12 (46%)	19 (56%)		
	Red	7 (27%)	9 (26%)		
The Tissue Types and Wound Healing Identification by Colour (After treatment)					
	Black	0 (0%)	0 (0%)		
	Yellow	9 (35%)	5 (15%)		
	Red	17 (65%)	29 (85%)		
Have Experiencing Arterial Wounds					
	Have	15 (58%)	0 (0%)		
	Don't have	11 (42%)	34 (100%)		
The Wound Healing and Frequency of Wound Care					
	3x	4 (15%)	16 (47%)	4.889	0.013
	>3x	22 (85%)	18 (53%)		

Suyanto, Sri Lestari Dwi Astuti*

Jurusan Keperawatan Politeknik Kesehatan Kemenkes Surakarta
Corresponding author. *E-mail: asri17894@gmail.comDOI: <https://doi.org/10.33024/minh.v6i1.9044>

The Last Evaluation of Tissue Types and Wound Healing				
Black	0 (0%)	0 (0%)		0.00 (Not exposed to Covid-19)
Yellow	6 (23%)	12 (35%)		0.16 (Exposed to Covid-19)
Red	20 (77%)	22 (65%)		

Based on table it can be seen that the number of male respondents is more than female. For the age group, the most are in pre-elderly. While respondents who were exposed to covid-19 were fewer than those who were not exposed to covid-19. The colour can be seen that there were black, yellow and red wound colors in respondents who were exposed and not exposed to covid-19 before treatment. After the respondent received wound care using moist techniques and modern dressings such as hydrocolloid, it was seen that there were no more black wounds that there is a significant difference in the wound healing of respondents based on the frequency of wound care (p value = .013 < 0.05) between respondents who have been exposed to covid-19 and who have never been exposed to covid-19. It can also be seen that the risk of respondents who have been exposed to covid-19 requires 4,889 times more frequency of wound care compared to those who are not exposed to covid-19.

That there is a significant difference in the wound healing of respondents who were exposed to covid-19 based on the frequency of wound care (p value = 0.049 < 0.05) between respondents who had and did not have arterial injuries. It can also be seen that the risk of respondents who were exposed to covid-19 and experienced arterial injuries required 1.114 times more frequency of wound care compared to those who did not experience arterial injuries.

Based on table that there was no significant difference in the condition of the wounds of respondents who were exposed to covid-19 before and after wound care (p value = 0.160 > 0.05) and that there is a significant difference in the condition of the wounds of respondents who were not exposed to covid-19 before and after wound care (p Value = 0.000 < 0.05). This condition is different from respondents who were exposed to covid-19 who did not experience

a difference in the condition of the wound before and after wound treatment.

DISCUSSION

Diabetic foot ulcers have emerged as one of the most serious chronic diseases and cause life-threatening complications, reduce life expectancy and are costly. The global prevalence of diabetes reported by the IDF (International Diabetes Foundation) has reached 9% (463 million adults) in 2019. The increasing prevalence of diabetes is mainly associated with population aging and risk factors for diabetes, especially obesity (Sun et al., 2022).

This is consistent with the results of research which found that the treatment of type 2 diabetes mellitus wounds using modern dressing techniques is more effective in wound healing, by accelerating granulation and healing of various types of dressings used according to wound conditions (Dimantika, Sugiyarto, & Setyorini, 2020). The same thing was revealed that from research on modern wound care using the moist wound healing method it was found that it was effective in the healing process of diabetic ulcers (Angria, Hariani, & Dwianti, 2019).

More specifically, the results of this study are consistent with the results of research that has found that modern (hydrocolloid) bandages are effective in healing diabetic wounds that often suffer from type II DM patients as a safe and effective healing method (Adriani & Mardianti, 2016). This is in accordance with the opinion that the pandemic has a negative impact on vascular wounds on the skin of diabetics, with an increased severity and risk of death compared to conditions before the pandemic (Sallustro & Florio, 2022). Besides that, it is proven that there is an influence of modern wound dressings on the wound healing process of diabetes mellitus. So that the average wound healing process before and after using

Suyanto, Sri Lestari Dwi Astuti*

Jurusan Keperawatan Politeknik Kesehatan Kemenkes Surakarta
Corresponding author. *E-mail: asri17894@gmail.com

DOI: <https://doi.org/10.33024/minh.v6i1.9044>

modern dressings decreases (Sitohang, 2020).

Diabetes mellitus is one of the most common comorbidities found in patients with covid-19. Approximately 7% of patients with covid-19 have diabetes as a comorbidity (Shenoy, Ismail & Bajaj, 2020). Sufferers of covid-19 must meet their nutritional needs even though they suffer from diabetes which must limit their intake of nutrients, especially carbohydrates, so this is a dual challenge for health workers caring for diabetics exposed to covid-19. Diabetes has been reported as a risk factor for disease severity and at the same time patients must control glucose in situations with decreased food intake (Madsbad, 2020).

The results of the study are in accordance with various opinions that diabetic patients have a risk of developing arterial disease such as arterial injuries, so it is said that PAD is very closely related to diabetes mellitus (Takahara, 2021). This is more common when it is associated with the 2019 Coronavirus (covid-19) which causes endothelial dysfunction because there has been hyper coagulation originating from endothelial injury so that patients are at risk of thrombosis and prone to get peripheral vascular disease which results in ischemia in critical extremities. Initially the covid-19 virus accelerated the formation and development of ulcers in diabetic patients which could be managed by a combination of endovascular and surgical interventions (Claesson, Köbel, & Acosta, 2021).

The same opinion was explained that one of the causes of diabetic foot wounds is peripheral arterial disease so that the treatment must be better so that it does not cause more severe complications (Atri, Kocherlakota, & Dasgupta, 2020). As explained from a study that found the results of 115 diabetic patients with foot ulcers with an average age of 73 years. After being treated for 17 months, 44% of the ulcers did not heal, 15% underwent major amputations and 42% died. This shows that there is no significant difference in terms of wound healing, major amputation or death. In conclusion, patients with diabetic foot ulcers and concomitant PAD are at high risk of limb loss and early death.

This study, which obtained the results that there

were differences in the frequency of foot wound care between those with arterial injuries and those who were not exposed to covid-19, is consistent with other studies. It was explained that patients with DFU often get peripheral arterial disease (PAD) as a macrovascular complication. Observational studies also show that coagulopathy is induced by covid-19 resulting in widespread development of arterial and venous thrombus in various places. Although the cause is still being studied, it seems to follow Virchow's triad, namely endothelial damage, internal procoagulants changes in circulation and blood flow.

It was found that the global prevalence of diabetic foot ulcers (DFU) is 6.3% with a recurrence rate of approximately 22.1% per person-year. The pandemic has posed many challenges in the management of diabetics especially with foot ulcer risk factors. Covid-19 infection has a tendency to exacerbate the neuro-ischemic component of DFU. This has been corroborated in a study from Italy where an increased incidence of acute limb ischemia was seen in patients who tested positive for covid-19. Given the procoagulant nature of covid-19 infection, it is possible that patients with diabetic foot ulcers, who have already compromised vascular supply, may exacerbate their leg symptoms and may develop an acute threatening limb crisis in need.

Opportunity to study the effects of covid-19 on the diabetic foot in terms of new ulcerations, deaths and amputations due to the pandemic. For this reason, it is necessary to monitor patients with previous covid-19 infection to understand whether previous infection increases the risk of DFS or amputation or death (Anichini, Cosentino, & Papanas, 2022).

Arterial wound conditions that are often difficult to treat require various forms of a combination of treatment and medication measures. It has been described that when diabetes mellitus is not well controlled with drugs and a healthy lifestyle, patients with advanced peripheral arterial disease or critical limb ischemia (CLI) face the most serious complications, especially lower limb ulcers. For this reason, various options for treating endovascular surgery, negative pressure wound therapy (NPWT), platelet-rich plasma (PRP), and wound dressings can

Suyanto, Sri Lestari Dwi Astuti*

Jurusan Keperawatan Politeknik Kesehatan Kemenkes Surakarta
Corresponding author. *E-mail: asri17894@gmail.com

DOI: <https://doi.org/10.33024/minh.v6i1.9044>

be performed (Grande, Fiori, Russo, Fioramonti, Campagnol, & Marzo, 2020).

Because the condition of foot wounds in diabetic patients who are exposed to covid-19 can experience different conditions from those who are not exposed to covid-19, diabetic foot ulcers require standard care which currently involves four principles: (1) pressure reduction, (2) debridement, (3) infection management, and (4) revascularization if indicated (Aldana, & Khachemoune, 2020).

The results of this study were supported by studies which found that there was a relationship between endothelial cell dysfunction in T2DM and covid-19 (Hayden, 2020). By therefore during the covid-19 pandemic the goal of treatment shifted to prevent the development of wound complications. So that patients will minimize their need to visit the hospital or clinic. It is given that based on the guidelines International Working Group on the Diabetic Foot (IWGDF), most patients with diabetic foot disease do not require hospitalization, unless they have a severe infection with possible sepsis or require surgical intervention.

In the future, it is hoped that in order to obtain accurate assessments and direct evaluations, technology can be used that provides a real-time method for wound assessment based on image analysis. So that clinical comparisons, determining the area of the wound, clinical evaluation with the wound healing status score algorithm can be obtained by (Wang, Pedersen, Strong, Tulu, Agu, Ignatz, & He, 2016).

For example, the first procedure is to conduct an online consultation (telemedicine) to assess the client's condition regarding complaints, then proceed with a triage process to prioritize treatment and service needs. The health of each patient and screening to check for symptoms of COVID-19 as well as additional screening, CT Thorax and Swabs if the patient has to go to the hospital (Hermawati, Tiranda, & Sukron, 2021).

CONCLUSION

There is a difference in the frequency of treating foot wounds in DM patients between those who are exposed to covid-19 and those who are not exposed to

covid-19. There is no difference in the condition of the foot wounds in DM patients who are exposed to covid-19 before and after being given wound care. Meanwhile, the condition of the foot wounds of DM patients who were not exposed to covid-19 before and after being given wound treatment had differences.

SUGGESTION

Wound care in diabetic patients should begin by reviewing their history of exposure to covid-19 so that wound care will be given more precisely and effectively.

REFERENCES

- Adriani, A., & Mardianti, T. (2016). Penggunaan balutan modern (hydrocolloid) untuk penyembuhan luka diabetes mellitus TIPE II. *Jurnal Iptek Terapan*, 10(1), 18-23. Retrieved from: <http://dx.doi.org/10.22216/jit.2016.v10i1.392>.
- Aldana, P.C., & Khachemoune, A. (2020). Diabetic Foot Ulcers: Appraising Standard of Care and Reviewing New Trends in Management. *American Journal of Clinical Dermatology*, 21(2), 255-264. Retrieved from: <https://link.springer.com/journal/40257>.
- Angrian, S., Hariani, H., & Dwianti, U. (2019). Efektifitas Perawatan Luka Modern Dressing Dengan Metode Moist Wound Healing Pada Ulkus Diabetik Di Klinik Perawatan Luka Etn Centre Makassar. *Jurnal Media Keperawatan*, Vol. 10(1), 19-24. Retrieved from: <https://journal.poltekkes-mks.ac.id/ojs2/index.php/mediakeperawatan/article/view/867>.
- Anichini, R., Cosentino, C., & Papanas, N. (2022). Diabetic foot syndrome in the covid-19 era: how to move from classical to new approaches. *The International Journal of Lower Extremity Wounds*, 21(2), 107-110. Retrieved from: <https://journals.sagepub.com/doi/abs/10.1177/15347346221081572#>.

Suyanto, Sri Lestari Dwi Astuti*

Jurusan Keperawatan Politeknik Kesehatan Kemenkes Surakarta
Corresponding author. *E-mail: asri17894@gmail.com

DOI: <https://doi.org/10.33024/minh.v6i1.9044>

- Atri, A., Kocherlakota, C. M., & Dasgupta, R. (2020). Managing diabetic foot in times of covid-19: time to put the best 'foot'forward. *International journal of diabetes in developing countries*, 40, 321-328. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7461755/>.
- Claesson, K., Kölbl, T., & Acosta, S. (2011). Role of endovascular intervention in patients with diabetic foot ulcer and concomitant peripheral arterial disease. *International angiology*, 30(4), 349-358. Retrieved from: <https://lup.lub.lu.se/search/publication/2058730>.
- Dimantika, A., Sugiyarto, S., & Setyorini, Y. (2020). Perawatan Luka Diabetes Mellitus Menggunakan Teknik Modern Dressing. *Jurnal Terpadu Ilmu Kesehatan*, vol 9 no 2, 117–268. Retrieved from: <https://doi.org/10.37341/interest.v9i2.210nalinterest.com/index.php/int/article/view/210>.
- Grande, R., Fiori, G., Russo, G., Fioramonti, P., Campagnol, M., & Marzo, L. (2020). A multistage combined approach to promote diabetic wound healing in COVID-19 era. *International Wound Journal*, 17(6), 1863-1870. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7461201/>.
- Hayden, M. R. (2020). Endothelial activation and dysfunction in metabolic syndrome, type 2 diabetes and coronavirus disease 2019. *Journal of International Medical Research*, 48(7), 0300060520939746. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7391440/>.
- Hermawati, H., Tiranda, Y., & Sukron, S. (2021). Health service for diabetic foot ulcer patients during covid-19 pandemic. *Media Keperawatan Indonesia*, 4(4), 311. Retrieved from: <https://jurnal.unimus.ac.id/index.php/MKI/article/view/7807>.
- International Diabetes Federation. (2019). IDF diabetes atlas. *International Diabetes Federation (9th editio)*. Retrieved from: <http://www.idf.org/about-diabetes/facts-figures>.
- International Diabetes Federation. (2021). IDF Diabetes Atlas, tenth. *International Diabetes*. Retrieved from: <https://diabetesatlas.org/atlas/tenth-edition/>.
- Madsbad, S. (2020). Covid-19 Infection in People with Diabetes. *Touch Endocrinology*. Retrieved from: <https://www.touchendocrinology.com/insight/covid-19-infection-in-people-with-diabetes/>.
- Prabawati, D., Sari, P., & Neonbeni, Y. (2021). Pendidikan Kesehatan Tentang Perawatan Dan Senam Kaki Pada Pasien Diabetes. *SELAPARANG Jurnal Pengabdian Masyarakat Berkemajuan*, 4(3), 624-630.
- Sallustro, M., & Florio, A. (2022). The impact of COVID-19 pandemic on vascular leg ulcers. *The International Journal of Lower Extremity Wounds*, 21(4), 661-666. Retrieved from: <https://doi.org/10.1177/15347346211010958>.
- Shenoy, A., Ismail, M., & Bajaj, M. (2020). Diabetes and covid-19: a global health challenge. *BMJ Open Diabetes Research and Care*, 8(1), e001450.
- Sitohang, R. (2020). Pengaruh Penggunaan Balutan Modern Terhadap Proses Penyembuhan Luka Diabetic Diklinik Asri Wound Care Center Medan Tahun 2019. Retrieved from: <http://poltekkes.aplikasi-akademik.com/xmlui/handle/123456789/2071>.
- Sun, H., Saeedi, P., Karuranga, S., Pinkepank, M., Ogurtsova, K., Duncan, B. B., & Magliano, D. J. (2022). IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes research and clinical practice*, 183, 109119. Retrieved from: <https://doi.org/10.1016/j.diabres.2021.109119>.

Suyanto, Sri Lestari Dwi Astuti*

Jurusan Keperawatan Politeknik Kesehatan Kemenkes Surakarta
Corresponding author. *E-mail: asri17894@gmail.com

DOI: <https://doi.org/10.33024/minh.v6i1.9044>

- Syafri, S. (2018, March). Pathophysiology diabetic foot ulcer. In *IOP Conference Series: Earth and Environmental Science* (Vol. 125, No. 1, p. 012161). IOP Publishing.
- Takahara, M. (2021). Diabetes mellitus and lower extremity peripheral artery disease. *Japan Medical Association journal*, 4(3), 225-231. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8355746/>.
- Tewahido, D., & Berhane, Y. (2017). Self-care practices among diabetes patients in Addis Ababa: a qualitative study. *PloS one*, 12(1), e0169062.
- Wang, L., Pedersen, P. C., Strong, D. M., Tulu, B., Agu, E., Ignatz, R., & He, Q. (2016). An automatic assessment system of diabetic foot ulcers based on wound area determination, color segmentation, and healing score evaluation. *Journal of diabetes science and technology*, 10(2), 421-428. Retrieved from: <https://doi.org/DOI:10.1177/1932296815599004> dst.sagepub.com.
- World Health Organization. (2016). *Global Report On Diabetes*. Retrieved from: https://apps.who.int/iris/bitstream/handle/10665/204871/9789241565257_eng.pdf;jsessionid=25997E172F338F45A91E50AD49DA90F2?sequence=1.

Suyanto, Sri Lestari Dwi Astuti*

Jurusan Keperawatan Politeknik Kesehatan Kemenkes Surakarta
Corresponding author. *E-mail: asri17894@gmail.com

DOI: <https://doi.org/10.33024/minh.v6i1.9044>