Eduvest – Journal of Universal Studies
Volume 2 Number 9, September, 2022
p- ISSN 2775-3735 - e-ISSN 2775-3727

PROFILE OF PEDIS GANGRENE PATIENTS WITH TYPE II DIABETES MELLITUS AT BHAYANGKARA HOSPITAL KEDIRI PERIOD JANUARY 2021 - MARCH 2022

R. Mohamad Javier, Yuswar Nurullah Sukin, Mochamad Yunus
Muhammadiyah University, Malang, Indonesia [123]
Email: javierbedah@webmail.umm.ac.id[1] yuswarnurullah@umm.ac.id[2] , yundokpol@gmail.com[3] , aleq_sander@umm.ac.id[4]

ABSTRACT

Gas gangrene is a disease that is identical to the incidence of type 2 diabetes mellitus with the characteristics of muscle necrosis / myonecrosis and is a very deadly infection of the inner soft tissues, often caused by gram-positive bacteria such as Staphylococcus aureus, Clostridium perifingens. Diabetes mellitus is a collection of symptoms caused by disturbances in the balance between carbohydrates, fats and proteins caused by absolute or relative insulin deficiency, causing hyperglycemia and glucosuria. to describe the profile of patients with gas gangrene pedis caused by type II diabetes mellitus obtained from the results of secondary data research at Bhayangkara Hospital Kediri Period January 2021 - March 2022. This study is an observational study (Non Experimental Design) using a cohort retrospective design method. The sample in this study were patients with Gas Gangrene Pedis who were obtained from the patient's medical records in the period January 2021 - March 2022 at Bhayangkara Hospital Kediri with Type II Diabetes Mellitus. Results: Based on the results of the Association Test between Wagner Grade and Gas Therapy, gangrene pedis has a p value of 0.199. The Wagner Grade variable with gas gangrene pedis therapy had an insignificant relationship with debridement measures n = 8 and the most common bacterium was Pseudomonas aeruginosa with n = 4. Patients with gas gangrene pedis who had a history of not routinely controlling because of their DM treatment, there was a high probability

How to cite: R. Mohamad Javier, Yuswar Nurullah Sukin, Mochamad Yunus. (2022). Profile Of Pedis Gas Gangrene Patients With Type II Diabetes Mellitus At Bhayangkara Hospital Kediri Period January 2021 - March 2022. Journal of Eduvest. *Vol 2* (9): Page 1868-1880
E-ISSN: 2775-3727
Published by: https://greenpublisher.id/

	of progressive progression. worsening of his condition due to metabolic neuropathy and the effect of different treatment outcomes for each patient
KEYWORDS	*Gas gangrene, Type II Diabetes Mellitus, Debridement, Pseudomonas aeruginosa*
	**This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International**

INTRODUCTION

Gas gangrene is a disease that is identical to the incidence of type 2 diabetes mellitus with the characteristics of muscle necrosis / myonecrosis and is a very lethal infection of the inner soft tissues, often caused by gram-positive bacteria such as Staphylococcus aureus, Clostridium perifingens (Buboltz & Murphy-Lavoie, 2019). Diabetes mellitus is a collection of symptoms caused by a disturbance in the balance between carbohydrates, fats and proteins caused by absolute or relative insulin deficiency, causing hyperglycemia and glucosuria (Erin, 2015). Type II diabetes mellitus occurs due to insulin resistance due to impaired glucose uptake and decreased production of pancreatic beta cells resulting in reduced insulin secretion and activity. Type II DM patients can be at risk for chronic complications such as CHD & stroke, kidney failure, retinopathy and diabetic gangrene (Erin, 2015). Avascular Necrosis / Osteonecrosis is a degenerative bone condition characterized by the death of bone cellular components due to impaired subchondral blood supply (Cruz et al., 2021). Often affects the epiphyses of long bones in joints that bear too much weight, or in bones where the surrounding tissue has an infection, one of which is caused by the bacterium Staphylococcus aureus (Fauzan, Saputra, & Mahmuda, 2019). Multiple Avascular Necrosis (MAVN) is an event of osteonecrosis that develops as a result of vascular disorders in the bone, causing necrosis of bone marrow cells, osteocytes and trabecular cells to cause bone collapse in the necrotic segment (Alalawi, Alnour, & Kosi, 2017). Incidence in the United States regarding the incidence of gangrene pedis is only about 1000 cases per year from the statistical results in December 2021, in less developed countries such as India with reduced access to health services and antibiotics, the incidence is higher and has a mortality rate of more than 67% of 8000 residents in India & Vietnam in 2019 (Buboltz & Murphy-Lavoie, 2019). The Indonesian Ministry of Health in 2012 stated that diabetes mellitus was included in the top ten non-communicable diseases with the highest number. In 2017, diabetes mellitus was the highest ranked non-communicable disease in the city of Semarang, with 21,159 cases which showed an increase in cases from the previous year (Rosa, Udiyono, Kusariana, & Saraswati, 2019). Epidemiological studies conducted by (Sukmana, Sianturi, Sholichin, & Aminuddin, 2020) show that in Indonesia there are more than one million cases of amputations each year due to diabetic gangrene. The proportion of people with diabetic gangrene in Indonesia is around 15% with an amputation rate of 30% (Rosa et al., 2019). Another study stated that the incidence of peripheral neuropathy due to multiple osteonecrosis in gangrene pedis patients obtained diabetic ulcers due to suffering from type II diabetes mellitus > 5 years with a risk level 2 times higher than < 5 years suffering from

type II diabetes mellitus (Sukmana et al., 2020). In the United States 10% of patients with multiple osteonecrosis occur in the age group 30-65 years, men tend to be more affected than women (Fatimah, 2015). The other 90% of cases are more often suffered by patients aged over 65 years with the term Keinbock disease / Crescent Osteonecrosis with the most patients being women than men, namely 3,125 residents of the United States. Indonesia, which is a developing country, (Fitri, 2021) type II diabetes mellitus, which becomes gangrene pedis, is still a significant health problem because the community's prevalence and mortality rate is still high and the lifestyle is still bad (Fauzan et al., 2019). One of the potential causes for the occurrence of Multiple Avascular Necrosis in Gangrene Pedis patients is a microorganism which is a facultative anaerobic bacterium, namely Staphylococcus aureus, where bacteria enter through soft tissue causing diabetic gangrene injuries (Alalawi et al., 2017), to cause peripheral neuropathy due to damage from the kidneys. blood supply to bone cells which results in the death of many bone cells in several parts or compartments and is a pathological process of bacterial infection from diabetic gangrene pedi (Sinaga, Nufus, & Setiyohadi, 2014).

Therapy in patients with gangrene pedis is very important and is carried out quickly and progressively with antibiotics, wound debridement in consultation with a surgical specialist, intravenous fluid resuscitation, ICU monitoring, and adjuvant hyperbaric oxygen therapy (Buboltz & Murphy-Lavoie, 2019). In addition, local astringents such as boric acid, tannic acid and antibacterial agents such as neobakrine ointment, can be given as a treatment for gangrene pedis, this can be given in combination with several other irritant drugs such as tincture of iodine, mercury bin-iodide with limited use and under the supervision of a surgical specialist. (Sukmana et al., 2020) The drug to eradicate bacterial infection in gangrene pedis is antibiotics. Antibiotics are defined as the result of production in the form of chemicals, where these materials can interfere with other microorganisms such as bacteria and fungi (Kaye, Petty, Shorr, & Zilberberg, 2019). Multiple osteonecrosis can be treated with prophylaxis or reconstructive surgery in other words, this therapy is to slow the progression of osteonecrosis by endoprosthetic replacement of the affected bone & soft tissue (Rahayu, Masfiyah, Puspitasari, & Sari, 2016). The most frequently used prophylactic surgery is core decompression of the femoral head, to prevent venous congestion and to stimulate repair (Nabiu, Anandani, & Hardiansyah, 2021). Decompression can also be performed at the malleoli pedis to improve mechanical support and promote healing of avascular necrosis caused by the bacterium Staphylococcus aureus in gangrene pedis, confirmed by arthroscopic examination of the joint showing varying degrees of chondral folds and features of joint degeneration with joint collapse due to gangrene pedis (Rina, Setyawan, Nugroho, Hadisaputro, & Pemayun, 2016). Administration of pencillin and clindamycin includes prophylactic therapy in patients with gangrene pedis (Buboltz & Murphy-Lavoie, 2019) with avascular necrosis because of its broad spectrum for Streptococcal group bacteria followed by continued physiotherapy thereafter (Matthews, Davis, Fish, & Stitson, 2021).

Ischemic foot is characterized by reduced blood supply. This relates to the symptoms of patients with gangrene pedis. Often found, patients complain of leg pain when standing, walking or when carrying out other physical activities. Pain

can also occur in the arcus pedis at rest or at night (Rosa et al., 2019). On examination, the skin discoloration becomes pale, thin and shiny or bluish in color (Sinaga et al., 2014). The feet are cold and the posterior tibial or popliteal pulse is difficult to palpate and ulcers are found that are difficult to heal and become gangrene (Rosa et al., 2019). When examining gangrene patients with peripheral neuropathy due to avascular necrosis, it was found that there were deformities and sclerotic changes around the patient's pedis, especially around the malleolus bone (Sukmana et al., 2020). Patients experience pain, especially when they want to walk, and pain is felt up to the patient's hip, this is found to be due to a nectrotic process in the bone in the femur on the side that has gangrene pedis, often called arthritic pain (Sukmana et al., 2020).

RESEARCH METHOD

This study uses quantitative methods with data obtained descriptively, the statistical test used is the Chi-square correlation statistical test from Pearson with a qualitative categorical data scale to determine a statistically significant relationship between independent and dependent variables with a significance degree of 5%. or = 0.05 through the Statistical Package for the Social Sciences (SPSS) program.

RESULTS AND DISCUSSION

A. Data Analysis Results

1. Descriptive statistics

Table 1
Descriptive statistics

		n	%	mean	stdev
Wagner Grade	Grade I	1	8.33		
	Grade II	4	33.33		
	Grade III	1	8.33		
	Grade IV	3	25.00		
	Grade V	3	25.00		
Gender	Man	7	58.33		
	Woman	5	41.67		
bacterial culture	Pseudomonas aeruginosa	8	66.67		
	Staphylococcus aureus	3	25.00		
	Streptococcus pyogenes	1	8.33		
long time DM II	Less than 1 Year	7	58.33		
	1 year and up	5	41.67		
Osteomyelitis	Negative	8	66.67		

	Positive	4	33.33		
Avascular necrosis	Negative	7	58.33		
	Positive	5	41.67		
Charcott	Negative	9	75.00		
	Positive	3	25.00		
DM therapy	Glibenclamide	1	8.33		
	Glimepiride	1	8.33		
	Long & Rapid Acting	1	8.33		
	Metformin	4	33.33		
	Rapid Acting Insulin	5	41.67		
Diabetic Foot Therapy	Amputation	4	33.33		
	Debridement	8	66.67		
Age		12		42.08	17.79
Hb		12		10.50	1.93
Leukocytes		12		204916.67	86379.14
Neutrophils		5		10300.00	1717.56
LED		5		21.40	1.67
GDA		12		295.42	42.61
HbA1c		12		8.33	0.49

2. Wagner Grade Comparison

The descriptive results of the comparison between Wagner Grades are presented in the following table.

Table 2
Wagner Grade Comparative Test Results

		N	mean	Std. Deviation
Hb	Grade I	1	10.00	.
	Grade II	4	10.50	1.29
	Grade III	1	10.00	.
	Grade IV	3	11.67	2.08
	Grade V	3	9.67	3.21
Leukocytes	Grade I	1	288000.00	.

	Grade II	4	176250.00		88635.49
	Grade III	1	110000.00	.	
	Grade IV	3	256666.67		50083.26
	Grade V	3	195333.33		113975.14
Neutrophils	Grade I	0	.	.	
	Grade II	2	11000.00		1414.21
	Grade III	1	9500.00	.	
	Grade IV	1	12000.00	.	
	Grade V	1	8000.00	.	
LED	Grade I	0	.	.	
	Grade II	2	20.50		0.71
	Grade III	1	20.00	.	
	Grade IV	1	24.00	.	
	Grade V	1	22.00	.	
GDA	Grade I	1	295.00	.	
	Grade II	4	270.00		44.16
	Grade III	1	280.00	.	
	Grade IV	3	343.33		32.15
	Grade V	3	286.67		32.53
HbA1c	Grade I	1	8.00	.	
	Grade II	4	8.25		0.50
	Grade III	1	8.00	.	
	Grade IV	3	8.33		0.58
	Grade V	3	8.67		0.58

Data source: Appendix 3

3. Wagner Grade Cross Tabulation

Wagner grade cross ablation results can be seen in Table 5.3

Table 3
Cross-tabulation results between Wagner Grade and Gender

Wagner Grade	Gender		Total	p
	Man	Woman		

Grade I	0	1	1	
Grade II	3	1	4	
Grade III	0	1	1	0.489
Grade IV	2	1	3	
Grade V	2	1	3	
	7	5	12	

Based on the results of the Association Test between Wagner Grade and gender, it has a p value of 0.489 ,. Because the significance value (p) is greater than =5%, the hypothesis H0 is accepted. This means that the Wagner Grade variable caused by gender has an insignificant relationship.

Table 4
Cross Tabulation Results between Wagner Grade and Bacterial Culture

Wagner Grade	bacterial culture			Total	p
	Pseudomonas aeruginosa	Staphylococcus aureus	Streptococcus pyogenes		
Grade I	1	0	0	1	0.805
Grade II	3	1	0	4	
Grade III	1	0	0	1	
Grade IV	1	1	1	3	
Grade V	2	**1**	0	3	
	8	3	1	12	

Based on the results of the Association Test between Wagner Grade and Bacterial Culture, it has a p value of 0.805 ,. Because the significance value (p) is greater than =5%, the hypothesis H0 is accepted. This means that the Wagner Grade variable caused by Bacterial Culture has an insignificant relationship.

Table 5
Cross-tabulation results between Wagner Grade and DM . duration

Wagner Grade	long time DM II		Total	p
	Less than 1 Year	1 year and up		
Grade I	1	0	1	
Grade II	3	1	4	
Grade III	1	0	1	0.187
Grade IV	2	1	3	
Grade V	0	3	3	

	7	5	12

Based on the results of the Association Test between Wagner Grade and DM duration, it has a p value of 0.187 ,. Because the significance value (p) is greater than =5%, the hypothesis H0 is accepted. This means that the Wagner Grade variable caused by the length of DM has an insignificant relationship.

Table 6
Cross-tabulation results between Wagner Grade and Complications of Osteomyelitis

Wagner Grade	Osteomyelitis		Total	p
	Negative	Positive		
Grade I	1	0	1	
Grade II	3	1	4	
Grade III	1	0	1	0.622
Grade IV	2	1	3	
Grade V	1	2	3	
	8	4	12	

Based on the results of the Association Test between Wagner Grade and Complications of Osteomyelitis, it has a p value of 0.622 ,. Because the significance value (p) is greater than =5%, the hypothesis H0 is accepted. This means that the Wagner Grade variable caused by Osteomyelitis Complications has an insignificant relationship.

Table 7
Cross-tabulation results between Wagner Grade and Complications of Avascular necrosis

Wagner Grade	Avascular necrosis		Total	p
	Negative	Positive		
Grade I	1	0	1	
Grade II	4	0	4	
Grade III	1	0	1	0.055
Grade IV	1	2	3	
Grade V	0	3	3	
	7	5	12	

Based on the results of the Association Test between Wagner Grade and Complications of Avascular necrosis, it has a p value of 0.055 ,. Because the

significance value (p) is greater than =5%, the hypothesis H0 is accepted. This means that the Wagner Grade variable caused by Complications of Avascular necrosis has an insignificant relationship.

Table 8
Cross-tabulation results between Wagner Grade and Charcott

Wagner Grade	Charcott		Total	p
	Negative	Positive		
Grade I	1	0	1	
Grade II	4	0	4	
Grade III	0	1	1	0.299
Grade IV	2	1	3	
Grade V	2	1	3	
	9	3	12	

Based on the results of the Association Test between Wagner Grade and Charcott, it has a p value of 0.299 ,. Because the significance value (p) is greater than =5%, the hypothesis H0 is accepted. This means that the Wagner Grade variable is caused by Charcott having an insignificant relationship.

Table 9
Cross-tabulation results between Wagner Grade and DM . therapy

Wagner Grade	DM therapy					Total	p
	Glibenclamide	Glimepiride	Long & Rapid Acting	Metformin	Rapid Acting Insulin		
Grade I	0	0	0	1	0	1	0.525
Grade II	0	0	0	2	2	4	
Grade III	0	0	0	0	1	1	
Grade IV	0	0	0	1	2	3	
Grade V	1	1	1	0	0	3	
	1	1	1	4	5	12	

Based on the results of the Association Test between Wagner Grade and DM therapy, it has a p value of 0.525 ,. Because the significance value (p) is greater than =5%, the hypothesis H0 is accepted. This means that the Wagner Grade variable with DM therapy has an insignificant relationship.

Table 10
Cross-tabulation results between Wagner Grade and Pedis Gangrene Therapy

Wagner Grade	Diabetic Foot Therapy		Total	p
	Amputation	Debridement		
Grade I	0	1	1	
Grade II	0	4	4	
Grade III	0	1	1	0.199
Grade IV	2	1	3	
Grade V	2	1	3	
	4	8	12	

Based on the results of the Association Test between Wagner Grade and Diabetic Foot Therapy, the p-value is 0.199 ,. Because the significance value (p) is greater than =5%, the hypothesis H0 is accepted. This means that the Wagner Grade variable with Diabetic Foot Therapy has an insignificant relationship.

A. Discussion

Profile of Pedis Gas Gangrene Patients with Type II Diabetes Mellitus at Bhayangkara Hospital Kediri Period January 2021-March 2022 was studied using a cohort retrospective design (Non Experimental Design) method by counting the number of gas gangrene patients with type II diabetes mellitus in Bhayangkara Hospital Kediri with several variables that have been determined previously, and the results obtained H0 are acceptable / there are no significant results, which means that the therapeutic target & treatment outcome varies between patients with Pedis gas gangrene with p> 0.05.

Some of the variables listed, some of which are not in accordance with the research conducted by Henry Setiawan with the secondary data observation method, it was found that the results of the univariate analysis showed that the average duration of diabetes > 2 years was 52.3% and the majority were male. 50.6% male with p < 0.05 or H1 is acceptable. The results of research conducted by researchers suggest that, Gas gangrene pedis is an infection, ulceration, and or destruction of deep connective tissue associated with neuropathy and vascular disease. Patients who have a history of non-routine control because of their DM treatment, there is a high possibility of worsening progression of the patient's gas gangrene condition, one of which causes metabolic neuropathy with different therapeutic outcomes for each patient because the tissue damage suffered by each gas gangrene pedis patient is different. different from wound healing which is faster in women 20-40% compared to men (Rina et al., 2016).

Research conducted by Hasneli, 2017 on the identification and analysis of blood sugar in diabetic patients, in 34 DM patients who were randomly assigned to obtain a median of 311.5 mg/dL with a minimum and maximum value of 195

mg/d: and 500 mg/dL, with a value of normal fasting blood sugar < 100 mg/dL. It was found that patients suffering from gas gangrene pedis with a median of 7 had a minimum value of 3 and a maximum of 9 on the left foot, 4 on the right foot and 9, which means that the blood sugar level of diabetic patients above normal can result in the sensitivity of the feet of patients with type II diabetes mellitus, this proves that different symptoms between patients which means that they are not significant or H0 are acceptable (Wahyuni, 2018) where the theory and results of the study are the same as the results of the studies previously discussed, especially with regard to the results of patients' blood sugar and type II diabetes mellitus.

Neurovascular disorders in diabetics include three neuropathy that occurs , namely: sensory neuropathy, motor neuropathy, autonomic neuropathy. Patients with type II diabetes mellitus who experience gangrene pedis suffer from vascular abnormalities in the form of ischemia, this is due to the macroangiopathic process and decreased tissue circulation which is characterized by loss or reduction of pulse of the dorsalis pedis artery, tibial artery and popliteal artery causing the feet to become atrophic, cold and nails thicken. . This often leads to complications in the form of Avascular Necrosis, Charcott disease, and/or Osteomyelitis in patients, starting from the tip of the foot or leg. The classification obtained in patients with gangrene pedis uses the Wagner-Meggit classification in the 1970s which has been developed and found there are 5 degrees with degrees 4 and 5 which are gangrene pedis on the soles of the feet and all over the feet (Buboltz & Murphy-Lavoie, 2019). Complications and clinical manifestations of each patient are different, based on the etiology of the condition of the patient's gangrene pedis. The cause of gangrene in patients with type II diabetes mellitus is anaerobic bacteria, the most common of which are Clostridium difficile, Pseudomonas aeruginosa because these bacteria produce gas and cause angiopathy. This theory is in accordance with what has been studied previously regarding the grading of diabetic foot / gangrene pedis based on Wagner-Meggitt, bacterial culture, disease complications that occur which have a theoretical relationship, but the incidence of each patient with different outcomes causes H0 to be accepted or not significant (Wahyuni, 2018).

Ischemic foot is characterized by reduced blood supply. However, in this situation, there are already neuropatic abnormalities at various stages. The patient complains of leg pain when standing, walking or doing other physical activities. The foot is cold, the posterior tibial or popliteal pulse is difficult to palpate. An ulcer was found due to local pressure on the patient's leg. The ulcer is difficult to heal and eventually becomes gangrene. Treatment of gas gangrene can be done by bed rest and control of blood glucose levels with diet, insulin or OAD, debridement of the patient's leg wound. Administration of topical antibiotics according to culture results or with broad-spectrum antibiotics. For the prevention of angiopathy can be given aspirin, dipyridamole. Surgery, namely immediate amputation, debridement and drainage can be carried out according to the existing grading or medical indications in patients with gangrene pedis (Cruz et al., 2021). In accordance with the results of existing studies, that the action or therapy given to patients has different indications, outcomes with the same goal of improving the condition of patients with gangrene pedis, which means it is not significant.

Based on the description above, this study is a descriptive study, because the results of the study provide an overview of the profile of gangrene pedis

patients with type II diabetes mellitus in the secondary data at Bhayangkara Hospital, Kediri according to the specified period, and see the number of patients who have been included according to the variable criteria specified. determined.

The weakness in this study is that there is no analytical study that explains which therapy has the most effect on patients, only descriptive statistics are explained because of the limited number of patients and pus culture is performed, so the number (n) is not sufficient for retrospective analytical studies.

This research is still an early study that has weaknesses and limitations, so further research is needed regarding the effect of analytical gangrene pedis therapy with type II diabetes mellitus to find out which therapy is the most effective or has an effect on patients according to their respective grading.

CONCLUSION

Based on the results of research and discussion in this study, the following conclusions can be drawn:

1. Blood sugar levels of diabetic patients above normal can result in decreased foot sensitivity of patients with type II diabetes mellitus.
2. Patients who have a history of non-routine control because of their DM treatment, there is a high possibility of worsening progression of the patient's gas gangrene condition, one of which causes metabolic neuropathy with different therapeutic outcomes for each patient because the tissue damage suffered by each gas gangrene pedis patient is different. different from wound healing which is 20-40% faster in women than men.
3. The most causative bacteria based on the results of the study were Pseudomonas aeruginosa with a result of n = 4. And the most frequently performed action on gas gangrene pedis patients was debridement with n = 8. Some patients who had a high level or grading did not choose to be amputated but only performed debridement only.
4. Patients with type II diabetes mellitus who experience gangrene pedis suffer from vascular abnormalities in the form of ischemia, in the form of Avascular Necrosis, Charcott disease, and/or Osteomyelitis in patients. From the results of the study, it was found that the most frequent complication was avascular necrosis with n = 5 compared to the incidence of other complications.
5. Based on the description above, this study is a descriptive study, because the results of the study provide an overview of the profile of gangrene pedis patients with type II diabetes mellitus in the secondary data at Bhayangkara Hospital, Kediri according to the specified period, and see the number of patients who have been included according to the variable criteria specified. determined.

REFERENCES

Alalawi, F., Alnour, H., & Kosi, M. E. (2017). Avascular Necrosis And Immunosuppression; A Management Dilemma. *Ann Clin Nephrol*, *1*(1), 1.

Buboltz, Jerome B., & Murphy-Lavoie, Heather M. (2019). *Gas Gangrene*.

Cruz, Karoliny Lisandra Teixeira, Camargos, Ana Cristina Resende, Cardoso, Juliana, Ramos, Aline Duprat, Mattiello-Sverzut, Ana Claudia, Burns, Joshua, & Leite, Hércules Ribeiro. (2021). Translation And Cross-Cultural Adaptation Of The Charcot-Marie-Tooth Disease Pediatric Scale To

Brazilian Portuguese And Determination Of Its Measurement Properties. *Brazilian Journal Of Physical Therapy*, *25*(3), 303–310.

Erin, Dwi. (2015). Gangrene Diabetik Pada Penderita Diabetes Melitus. *Jurnal Agromedicine*, *2*(4), 408–412.

Fatimah, Restyana Noor. (2015). Diabetes Melitus Tipe 2. *Jurnal Majority*, *4*(5).

Fauzan, Iqbal Hilmi, Saputra, Angga Nuralam, & Mahmuda, Iin Novita Nurhidayati. (2019). *Acute Limb Ischemia: Pendekatan Diagnosis Dan Penanganannya*. Proceedings Of Continuing Medical Education, Workshop And Symposium ….

Fitri, Shiva Alya. (2021). *Gambaran Jumlah Trombosit Pada Penderita Diabetesmelitus Tipe 2 Di Rumah Sakit Systematic Review*.

Kaye, Keith S., Petty, Lindsay A., Shorr, Andrew F., & Zilberberg, Marya D. (2019). Current Epidemiology, Etiology, And Burden Of Acute Skin Infections In The United States. *Clinical Infectious Diseases*, *68*(Supplement_3), S193–S199.

Matthews, Alexander H., Davis, Donald D., Fish, Michael J., & Stitson, David. (2021). Avascular Necrosis. In *Statpearls [Internet]*. Statpearls Publishing.

Nabiu, M. Rifaldi, Anandani, Adinta, & Hardiansyah, Nico Perdana. (2021). Karakteristik Pasien Osteomielitis Di Rumah Sakit Pusat Infeksi Prof Dr. Sulianti Saroso. *The Indonesian Journal Of Infectious Diseases*, *7*(1), 35–45.

Rahayu, Rahayu, Masfiyah, Masfiyah, Puspitasari, Iva, & Sari, Desvita. (2016). Diagnosa Gas Gangren Cruris Dextra Oleh Clostridium Perfringens (Laporan Kasus). *Proceeding Foki*, *1*(1), 96–101.

Rina, Rina, Setyawan, Henry, Nugroho, Heri, Hadisaputro, Suharyo, & Pemayun, Tjokorda Gde Dalem. (2016). Faktor-Faktor Risiko Kejadian Kaki Diabetik Pada Penderita Diabetes Melitus Tipe 2 (Studi Kasus Kontrol Di Rsup Dr. M. Djamil Padang). *Jurnal Epidemiologi Kesehatan Komunitas*, *1*(2), 48–60.

Rosa, Satya Kirana Dela, Udiyono, Ari, Kusariana, Nissa, & Saraswati, Lintang Dian. (2019). Faktor-Faktor Yang Berhubungan Dengan Timbulnya Gangren Pada Pasien Diabetes Mellitus Di Rsud Krmt Wongsonegoro Semarang. *Jurnal Kesehatan Masyarakat (Undip)*, *7*(1), 192–202.

Sinaga, A., Nufus, H., & Setiyohadi, Bambang. (2014). Avascular Necrosis Of The Right Femoral Head In Female Patient With Systemic Lupus Erythematosus. *Indonesian Journal Of Rheumatology*, *5*(1).

Sukmana, Mayusef, Sianturi, Roni, Sholichin, Sholichin, & Aminuddin, Muhammad. (2020). Pengkajian Luka Menurut Meggit-Wagner Dan Pedis Pada Pasien Ulkus Diabetikum. *Jurnal Kesehatan Pasak Bumi Kalimantan*, *2*(2), 79–88.

Wahyuni, Sri. (2018). *Hubungan Kadar Gula Darah Dengan Terjadinya Gangren Pada Pasien Diabetes Militus*.