REVIEW ARTICLE

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SOCIETY FOR VASCULAR SURGERY WOUND, ISCHEMIA AND FOOT INFECTION (WIFI) CLASSIFICATION SYSTEM: CHARACTERIZATION OF WOUNDS

SISTEMA DE CLASSIFICAÇÃO DA SOCIEDADE DE CIRURGIA VASCULAR WOUND, ISCHEMIA, FOOT INFECTION (WIfI): CARACTERIZAÇÃO DAS FERIDAS

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ABSTRACT

Objective: To identify the characteristics and severity of wounds in studies with classification of the WIfI System (Wound; Ischemia; foot Infection). Method: This is an integrative literature review, of a descriptive nature. Searches were performed at the MEDLINE and Virtual Health Library (VHL) databases, using the descriptors in English: "wound healing", "amputation", "diabetic foot" and "peripheral vascular disease". The search identified 54 publications, and, after analysis and application of inclusion and exclusion criteria, 12 articles remained. Results: There was a predominance of studies with level of evidence 2B according to the Oxford Center Classification for Evidence-Based Medicine. Regarding the patients' profile, those with peripheral arterial disease who underwent limb revascularization predominated. A complex wound profile was found, medium to large in size, with little possibility of healing without a multidisciplinary action. Conclusion: The research showed that the main characteristics about the wounds presented in studies using the classification of the WIfI System (Wound; Ischemia; foot Infection) were wounds with bone exposure and extensive wounds. Thus, nursing professionals, as members of the multidisciplinary team, should know the WIfI classification, in order to be able to identify and refer a patient with ischemia for revascularization earlier.

Keywords: Healing; Amputation; Classification System.

RESUMO

Objetivo: Identificar as características e gravidade das feridas em estudos com classificação do Sistema WIfI (Wound; Ischemia; foot Infection). Método: Trata-se de uma revisão integrativa de literatura, de caráter descritivo. Foram realizadas buscas nas bases de dados MEDLINE e Biblioteca Virtual da Saúde (BVS) sendo utilizados os descritores em inglês: "wound healing", "amputation", "diabetic foot" e "peripheral vascular disease". Identificou-se 54 publicações, após análise e aplicação de critérios de inclusão e exclusão permaneceram 12 artigos. Resultados: Houve predominância de estudos com nível de evidência 2B conforme a Classificação de Oxford Centre for Evidence-Based Medicine. O perfil de pacientes predominou aqueles com doença arterial periférica submetidos à revascularização do membro. Foi encontradas perfil de feridas complexas, tamanho médio a extensas, com pouca possibilidade de cicatrização sem uma ação multiprofissional. Conclusão: A pesquisa evidenciou que as principais características sobre as feridas apresentadas em estudos com a utilização da classificação do Sistema WIfI (Wound; Ischemia; foot Infection), foram feridas com exposição óssea e feridas extensas. Assim, é primordial que os profissionais de enfermagem como integrantes da equipe multiprofissional conheçam a classificação WIfI, assim poderá identificar e encaminhar um paciente com isquemia para revascularização mais precocemente.

Palavras-Chave: Cicatrização; Amputação; Sistema de Classificação

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INTRODUCTION

Diabetes is a worldwide public health problem. According to the authors [1], the main complication of diabetes is diabetic foot, which is "one of the most serious complications", with high costs for health institutions and worsening the patient's quality of life [1].

Authors' studies [2] "about 15% of patients with diabetes will develop an ulcer". This is one of the main complications of diabetes, with high costs for health services. The presence of foot ulcers in diabetic patients leads to an increase in mortality [2], The authors [3] also add that diabetic foot ulcer is one of the main causes of hospital admissions and amputation. However, studies indicate that 25% of ulcers do not have a prospect of healing[4]. Another unfavorable outcome for diabetic foot ulcer stems from lower limbs, and every year 1 million people with diabetes are amputated, which means that every 20 seconds a person has a limb amputated due to diabetes[4]. In view of its systemic involvement, affecting the macrovasculature and microvasculature part[5], its association with peripheral arterial disease, it can further increase amputation and mortality rates.

The main causative factor of peripheral arterial disease (PAD) is atherosclerosis, which has been described as a common pathology, with a prevalence of up to 10% in people aged under 70 years and up to 20% in the world population above this age. In Brazil, the prevalence is around 10.5% [6].

Recently, the American Society of Vascular Surgery has developed a classification to monitor and diagnose ischemia adequately, especially those patients with diabetes, aiming to stratify the risk of amputation in one year and the benefits of revascularizing the threatened lower limb based on three factors: a) Wound; b) Ischemia and; c) foot Infection. Using the initials WIfI to better describe the factors[7].

Thus, each factor has a scale from 0 to 3 – wound, ischemia and infection. For the wound, grade 0 represents no wound; grade 1 - superficial wound that affects a maximum of two digits; grade 2 – wound on the forefoot and may affect more than two digits, with or without bone and tendon exposure and/or superficial ulcer in the heel; grade 3 – extensive wound on the foot and/or deep ulcer affecting the heel. For ischemia, the ankle arm index (AAI)[8], which measures ankle systolic pressure and divides by systolic pressure of the arm, grade 0- with ankle arm index (AAI) equal to or greater than 0.80; grade 1 - with AAI from 0.60 to 0.79; grade 2 - AAI from 0.40 to 0.59; grade 3 - AAI less than or equal to 0.39. For infection, grade 0 - no infection; grade 1 - local infection; grade 2 - local infection with ascending hyperemia above 2 cm; grade 3 - severe infection with signs of sepsis. Based on these three scores, there are four clinical stages that correspond to the risk

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of amputation in one year, considering that as the disease progresses the risk of amputation increases, from stage 1 (very low risk) to stage 4 (high risk). Another evaluation of the WIfI Classification is to predict the benefit of revascularization in the threatened limb[9].

The correct categorization of each factor present in the ulcer genesis of the diabetic foot patient (wound, ischemia and infection) can indicate the individual improvement approaches for the patient, through the specific knowledge of his/her prognosis regarding the probability of amputation and its benefit through revascularization surgery.

According to [10], wound evaluation corresponds to a part of the patient's evaluation, thus, we should evaluate all the issues involving the patient, in the areas: social, emotional/psychological, nutritional, and physical. Only after this evaluation can we characterize and even diagnose the wound[10]. Diabetic foot ulcers have very peculiar characteristics, such as location, size, bed, pulses and pain. Identifying the characteristics is necessary, since the patient with diabetic foot may present ischemia of the limb; without this prior identification, the professional can cause harm to the patient, and may even lead him/her to an amputation if he/she does not perform the assessment properly [10].

In view of this classification and seeking to update the knowledge and evaluation of data regarding diabetic foot wound and PAD, contributing to improve the actions of the multidisciplinary health team, providing individualized and quality care, through the implementation of strategies with the objective of reducing the number of major amputations, readmissions, cost and deaths. The results of this study are expected to contribute to the reorganization of the service, continuing education, making viable the assumptions of the Unified Health System. Due to the relevance of the theme, the study seeks to answer the following guiding question: What are the main characteristics about wounds presented in studies using the WIfI classification system (Wound; Ischemia; foot Infection)?

In this context, the present work aims to identify the main characteristics and severity of wounds presented in studies using the classification of the WIfI System (Wound; Ischemia; foot Infection).

METHOD

This is an integrative review. This type of study is the "methodological approach related to reviews, allowing the inclusion of experimental and non-experimental studies for a complete understanding of the analyzed phenomenon"[11]. The five stages were completed: 1) Formulation of the problem; 2) Search in the literature; 3) Evaluation of the data; 4) Data analysis (to categorize the data) and 5) Presentation of the results.

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In the first stage, the following research question was formulated: What are the main characteristics about the wounds presented in studies using the WIfI classification system (Wound; Ischemia; foot Infection)?

In the search at dsatabase, search strategies formed by descriptors and synonyms contained in the Health Sciences Descriptors – DeCS in the English language were used: “wound healing”, “amputation”, “diabetic foot” and “peripheral vascular disease”, combined through the Boolean operators AND and OR, and through the search for the term “classification WIfI”.

The following electronic databases were used to survey data: Virtual Health Library (VHL) and Medical Literature Analysis and Retrieval System Online (MEDLINE).

The inclusion criteria to select the articles were: a) articles published from the year 2014; b) articles fully available; c) published in any language. Articles that were not related to nursing were excluded. The information evaluated was: 1) Level of evidence based on the Oxford Centre for Evidence-Based Medicine classification; 2) Year of publication; 3) Profile of patients analyzed in the studies; 4) Wound characteristics, according to WIfI classification;

The database search took place in August 2019. The initial search resulted in 54 publications. Subsequently, the titles and abstracts of the articles were read, excluding 20 that did not meet the inclusion and exclusion criteria. Then, the remaining articles were fully read, eliminating 8 articles. Thus, 12 articles comprise the final sample of the study.

The articles in the final sample were classified according to the level of evidence, according to the Oxford Centre for Evidence-Based Medicine Classification: a) level 1A - systematic review in randomized clinical trials; b) level 1B - randomized controlled clinical trial with narrow confidence interval; c) level 2A- systematic review of cohort study; d) level 2B - cohort study; e) level 2C - ecological study, observation of therapeutic results; e) level 3A - systematic review of control case study; f) level 3B - case study - control; g) level 4 - case report; h) level 5 - opinion devoid of critical evaluation or based on basic subjects.

Some characteristics of the articles obtained were inserted in synoptic charts containing the following information: article title, year of publication, level of scientific evidence, profile of patients analyzed and description of the wound according to the WIfI Classification System.

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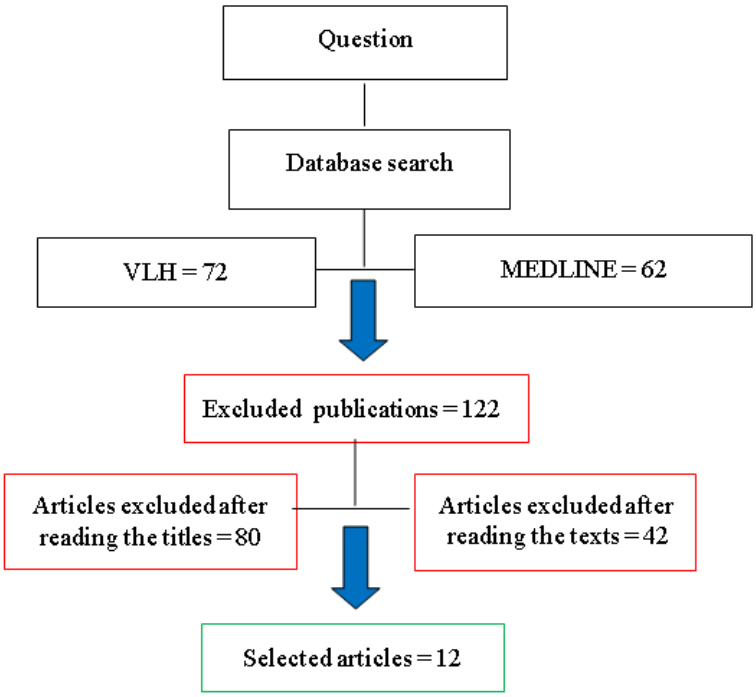
Figure 1 - Flowchart of the methodological steps for selecting the manuscripts. Belo Horizonte, Minas Gerais, Brazil – 2019.



The characteristics of the wounds according to the WIfI Classification System were considered, in which grade 0 represents no wound, grade 1 when the wound is smaller than 1 cm², shallow, grade 2 when the wound measures around 1 to 3 cm² and there may be bone or tendon exposure, gangrene involving more than 2 digits and involving the calcaneus tissue and grade 3 when the wound was measured with > 3 cm², extensive ulcer, which may involve the forefoot and may affect the heel bone [12].

RESULTS

The saerch for the articles through Medline, this being a tool to search for scientific articles in the health area, using the following keywords: Wound healing; Diabetic foot; Peripheral vascular disease, did not return any results, thus using the term: classification WIfI. Following the search strategy, refining for publications in the period from January 2014 to June 2019.

There was a predominance of studies with evidence level 2B according to the Oxford Centre for Evidence-Based Medicine classification (Chart 1 and 2). All studies were conducted in other countries, demonstrating the absence of studies with the WIfI Classification, which predicts the risk of major amputation in 1 year and the benefits of revascularizing the affected limb. Regarding the year of publication, the oldest studies were also those with low scientific evidence, and

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the publications on specialist concepts for publication of the WIfI Classification instrument.

There was predominance of patients with peripheral arterial disease submitted to limb revascularization before starting studies, in the case of retrospective studies.

Chart 01- Scientific production, regarding the level of evidence, year of publication, patient profile and stages of the WIfI classification. Belo Horizonte - MG, Brazil, 2019.

No.	Title	Year	Level of evidence	Profile	Stages of the WIfI Classification
1	Clinical application of the Society for Vascular Surgery (SVS) Lower Extremity Threatened Limb Classification system: risk stratification based on Wound, Ischaemia, and foot Infection (WIfI)[13]	2014	Level 4	Diabetic patients	Stages 2 and 3
2	Peripheral Vascular Disease, Infection, Foot Ulcers, and the WIfI Classification System [14]	2018	Level 5	PAD and DM	-
3	The Society for Vascular Surgery Wound, Ischemia, and foot Infection (WIfI) classification system correlates with cost of care for diabetic foot ulcers treated in a multidisciplinary setting [15]	2018	Level 2B	PAD and DM	31%: Stage 1, 16%: Stage 2, 30%: Stage 3 and 24%: Stage 4
4	The Correlation of the Society for Vascular Surgery Wound, Ischemia, and foot Infection Threatened Limb Classification with Amputation Risk and Major Clinical Outcomes [16]	2018	2A	PAD and DM	3,8% Stage 1, 8,6% Stage 2, 9,7% Stage 3 and 23,8% Stage 4
5	Validation of the Wound, Ischemia, foot Infection (WIfI) classification system in nondiabetic patients treated by endovascular means for critical limb ischemia[17]	2016	2B	Revascularized PAD	21,2% Stage 0, 25,6% Stage 1, 21,8% Stage 2,

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					25% Stage 3 and 6,2% Stage 4
6	Society for Vascular Surgery limb stage and patient risk correlate with outcomes in an amputation prevention program [18]	2016	2B	Diabetic patients	13% Stage 1, 29% Stage 2, 25% Stage 3 and 29% Stage 4

* PAD: Peripheral arterial disease; DM: Diabetes Mellitus

Note: Level of scientific evidence according to the Oxford Centre for Evidence – Based Medicine Classification
Source: Created by the authors (2019).

Chart 02- Scientific production, regarding the level of evidence, year of publication, patient profile and stages of the WIfI classification. Belo Horizonte - MG, Brazil, 2019.

No.	Title	Year	Level of evidence	Profile	Stages of the WIfI Classification
7	An early validation of the Society for Vascular Surgery Lower Extremity Threatened Limb Classification System [12]	2014	2B	PAD	25,3% Grade 1, 40,5% Grade 2, 29,1% Grade 3 5% Grade 4
8	Predictive Ability of the SVS WIfI Classification System Following Infrapopliteal Endovascular Interventions for CLI[19]	2016	2B	PAD	0,1% Grade 1, 20,2% Grade 2, 40,5% Grade 3 38,9% Grade 4
9	Predictive Ability of the SVS WIfI Classification	2017	2B	PAD	1,2% Grade 1,

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	System following First-time Lower Extremity Revascularizations[20]				29,5% Grade 2, 25,1% Grade 3 44,1% Grade 4
10	Society for Vascular Surgery Wound, Ischemia, foot Infection (WIfI) score correlates with the intensity of multimodal limb treatment and patient-centered outcomes in patients with threatened limbs managed in a limb preservation center [21]	2017	2B	PAD and DM foot	16,3% Grade 1, 22,9% Grade 2, 24,1% Grade 3 7% Grade 4
11	Use of the Wound, Ischemia, foot Infection classification system in hemodialysis patients after endovascular treatment for critical limb ischemia[22]	2017	2B	Dialysis PAD	9,8% Grade 1, 18,4% Grade 2, 34,3% Grade 3 37,4% Grade 4
12	The Society for Vascular Surgery lower extremity threatened limb classification system based on Wound, Ischemia, and foot Infection (WIfI) correlates with risk of major amputation and time to wound healing [9]	2015	2Bd	PAD	19,4% Grade 1, 24,8% Grade 2, 26,3% Grade 3 29,3% Grade 4

* PAD: Peripheral arterial disease; DM: Diabetes Mellitus
Note: Level of scientific evidence according to the Oxford Centre for Evidence – Based Medicine Classification
Source: Created by the authors (2019).

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Verifying the studies, only six described the wounds (Chart 3), three studies presented only healing and the others reported the total result of the WIfI Classification directing to major amputation and amputation-free survival.

Chart 03- Distribution of publications included in the integrative review according to the year of publication, title and grade of the wound according to the WIfI Classification, Belo Horizonte - MG, Brazil, 2019.

No.	Title	Year	Gradand of thand wound (WIfI Classification)
2	Peripheral Vascular Disease, Infection, Foot Ulcers, and the WIfI Classification System [14]	2018	Grade 1 and Grade 2
3	The Society for Vascular Surgery Wound, Ischemia, and foot Infection (WIfI) classification system correlates with cost of care for diabetic foot ulcers treated in a multidisciplinary setting [23]	2018	Grade 1
4	The Correlation of the Society for Vascular Surgery Wound, Ischemia, and foot Infection Threatened Limb Classification with Amputation Risk and Major Clinical Outcomes [16]	2018	Grade 2 and Grade 3
5	Validation of the Wound, Ischemia, foot Infection (WIfI) classification system in nondiabetic patients treated by endovascular means for critical limb ischemia [17]	2016	Grade 1 and Grade 2
7	An early validation of the Society for Vascular Surgery Lower Extremity Threatened Limb Classification System [12]	2014	Grade 2 and Grade 3
10	Society for Vascular Surgery Wound, Ischemia, foot Infection (WIfI) score correlates with the intensity of multimodal limb treatment and patient-centered outcomes in patients with threatened limbs managed in a limb preservation center [21]	2017	Grade 1 and Grade 2

Source: Created by the authors (2019).

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DISCUSSION

The main characteristics of wounds presented in studies using the WIfI classification system (Wound; Ischemia; foot Infection) were grade 2 wounds of the lesions located in the forefoot, affecting two or more digits and/or superficial ulcers in the heel, with or without bone and tendon exposure. However, some studies presented grade 2 and 3 wounds, representing a greater severity in relation to the extent and depth of the wounds, subjecting the patient to high risks for major amputation.

In view of the concern of the high rates of non-traumatic amputation and mortality, several strategies and tools are needed to assist the professional and the team in the search for alternatives that accelerate decision-making and early therapy. The wound has been an important factor for amputation risk, being evaluated together with two other factors of equal importance, i.e., ischemia and infection. Previously, ischemia was the only characteristic considered as a risk factor for major amputation, which is described as amputations above the ankle (transtibial, knee disarticulation, transfemoral or hip disarticulation) [24] in which the patient needs to use prosthesis to walk, and the wound and infection were not considered as contributing factors, but, after the Diabetes epidemic and evolution of ischemia treatment with revascularization, it was noticed that there are other contributing factors for amputation, not considering ischemia as an isolated factor, beginning a more detailed look for the size and location of the wounds and the severity of the infection [7].

The WIfI Classification was elaborated by specialists who identified the need for a prognostic tool that addressed the three characteristics that have strongly contributed to amputation and mortality, being considered an easy-to-use instrument and a tool to assist in directing care for revascularization, as well as treatment of infection and local treatment of wounds [7].

It is known that the observer's description and evaluation can interfere in the result of the classification, because it is the professional's knowledge that determines a correct classification [25]. The studies found were conducted by large international reference centers for amputation prevention, thus the evaluations and classifications might have been performed more accurately. In this study, we observed that the characteristics of the wounds remained with a profile of mild to moderate, most with grade 2 ulcers with areas between 1 cm^2 and 3 cm^2, bone exposure and that may affect the calcaneus superficial tissue, followed by grade 1 with shallow ulcers of size below 1 cm^2 or with involvement of 1 or 2 digits. Thirdly, grade 3

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wounds with size above 3cm² with calcaneus involvement.

Wound size is assessed by the WIfI classification to predict the possible level of amputation and/or possibilities in healing. The authors[26] add that wound size is an important factor for successful healing. The authors [27] described that the wound area increased as the WIfI stage increased, presenting in stage 1 – 2.6 cm^2 and stage 4 with 15.3 cm^2, for depth in stage 1 – 0.2 cm and stage 4 0.8 cm. The healing time in this study was around 190 days [27]. Cull *et al* (2014) [12] report a healing rate of 79%, identifying mostly wounds with grade 2 and 3, demonstrating severity and great extent of these wounds, requiring several multidisciplinary interventions to achieve those healing rates, also described as a factor that interferes in the healing of diabetes, wound size and depth and location [12].

This profile of wounds generates negative results not only for the patient, but also for health institutions and society as a whole, because every day we have more people with diabetes and increasingly younger people with amputations, reducing the number of economically active people in the labor market and increasing the costs of their treatment. The impact of amputation goes beyond the financial factor, emotional issues. According to a study[28], patients present negative perception with rejection of their own image, also reporting that they believe that other people also see them negatively, generating important emotional and psychological conflicts to them [28]. Driver *et al* [29] report that the costs of treating wounds with a higher degree increase by up to eight times the value in relation to lower-grade wounds [29].

The authors[17] state that the wound healing rate reduced as the stages of the WIfI classification increased, thus the higher the severity of the wound, the lower the chances of wound healing [17]. These factors described in the study[12] demonstrate that nurses' role with preventive measures such as guidance with health education, and early identification of wounds can facilitate healing. After healing, follow-up is necessary to avoid recurrences, through health education, a strategy that can avoid up to 75% of recurrent wounds [30].

The identification of the wound and its degree of complexity is necessary to the nurse, as this professional performs the dressings and usually defines the therapies for topical treatment. The authors[31] affirm the importance of nurses in assuming responsibility in "maintaining observation in relation to local, systemic and external factors that condition the appearance of the wound or interfere in the healing process"[31]. Thus, knowing and applying the WIfI classification as a system of clinical decision support by nurses is valid[32] for this resumption of actions and responsibility regarding the

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treatment of patients with wounds, enabling improvements in the quality of life of the patient and reduction of costs with the treatment of wounds. Another important action of the nurse regarding the degree of wounds is to be attentive to health education, because it contributes to self-care and prevention of new complications[33].

CONCLUSION

The present study answered the guiding question describing the characteristics of wounds according to the WIfI Classification System (Wound; Ischemia; foot infection). According to the exposed in this study, the main characteristics were wounds with bone exposure, above 1 cm² and extensive wounds.

The WIfI classification is an important tool to assist the team in decision making, aims to stratify the risk of amputation in one year and the benefits of revascularizing the threatened lower limb based on three factors: 1) Wound; 2) Ischemia and; 3) foot Infection, the target population of this classification includes any patient with ischemic pain at rest, diabetic foot ulcer, ulcer in the foot or lower limbs for at least two weeks of duration.

The studies analyzed were enlightening about the severity of wounds in patients classified according to the WIfI Classification, also contributing to the description of the new wound evaluation system, as well as identification of the profile and characteristics of the wounds of the patients evaluated in each study.

In general, all objectives were achieved by demonstrating the characteristics of the wounds evaluated in studies with the WIfI classification, as well as described the need for multiprofessional action to avoid amputations and increase the rate of wound healing.

For nurses, knowing this classification is necessary, since this professional receives and follows up patients with wounds. The nurse who knows the classification may examine more efficiently, referring the patient to the evaluation of the vascular surgery specialist as early as possible, contributing to an adequate treatment and avoiding larger amputations and mortality.

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Submission: 2020-03-08

Approval: 2020-07-15