

CUIDADO É FUNDAMENTAL

UNIVERSIDADE FEDERAL DO ESTADO DO RIO DE JANEIRO • ESCOLA DE ENFERMAGEM ALFREDO PINTO

RESEARCH

DOI: 10.9789/2175-5361.2018.v10i2.441-449

Tecnologia da espuma de poliuretano com prata iônica e sulfadiazina de prata: aplicabilidade em feridas cirúrgicas infectadas

Polyurethane foam technology with ionic silver and silver sulfadiazine: applicability in infected surgical wounds

Tecnología con sulfadiazina de plata y plata iónica de espuma de poliuretano: aplicación en heridas quirúrgicas infectadas

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How to quote this article:

Franco VQ; Souza NVDO; Pires AS; et al. Polyurethane foam technology with ionic silver and silver sulfadiazine: applicability in infected surgical wounds. Rev Fund Care Online. 2018 abr/jun; 10(2):441-449. DOI: <http://dx.doi.org/10.9789/2175-5361.2018.v10i2.441-449>

ABSTRACT

The objective of the research is to describe the healing process of infected surgical wounds with the use of polyurethane foam with ionic silver and silver sulfadiazine. This is an observational, descriptive, prospective series type of data held in a curative clinic of a public hospital in the city of Rio de Janeiro. Four survey participants had wound infection. Data collection occurred from March to May 2016. The data collection instrument was the PUSH. The results showed that all study participants followed from beginning to end of treatment showed significant changes in relation to the size of the lesion with fast healing process, decreasing the amount of exudate and appearance of granulation and epithelial tissues. The foam showed better results by having all the properties of an ideal dressing.

Descriptors: Nursing; Case study; Dehiscence of operatory wound.

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RESUMO

O objetivo da pesquisa é descrever o processo cicatricial de feridas cirúrgicas infectadas com a utilização de espuma de poliuretano com prata iônica e sulfadiazina de prata. Trata-se de estudo observacional, descritivo, prospectivo do tipo série de dados, realizada em um ambulatório de curativos de um hospital público no município do Rio de Janeiro. Os 4 participantes da pesquisa possuíam infecção de ferida operatória. A coleta de dados ocorreu de março a maio de 2016. O instrumento de coleta de dados foi o PUSH. Os resultados evidenciaram que todos os participantes do estudo acompanhados do início ao término do tratamento apresentaram alterações significativas em relação ao tamanho da lesão com rápido processo de cicatrização, diminuição da quantidade de exsudato e surgimento dos tecidos de granulação e epitelial. A espuma apresentou melhores resultados por apresentar todas as propriedades de um curativo ideal.

Descritores: Enfermagem; Estudo de Casos; Deiscência da Ferida Operatória.

RESUMEN

El objetivo de la investigación es para describir el proceso de curación de las heridas quirúrgicas infectadas con el uso de espuma de poliuretano con plata iónica y sulfadiazina de plata. Se trata de un tipo prospectivo observacional, descriptivo, serie de los datos contenidos en una clínica curativa de un hospital público en la ciudad de Río de Janeiro. 4 participantes de la encuesta habían infección de la herida. Los datos fueron recolectados entre marzo y mayo de 2016. El instrumento de recolección de datos fue el empujón. Los resultados mostraron que todos los participantes en el estudio seguido de principio a fin del tratamiento mostraron cambios significativos en relación con el tamaño de la lesión con proceso de curación rápida, disminuyendo la cantidad de exudado y la apariencia de la granulación y tejidos epiteliales. La espuma mostró mejores resultados al tener todas las propiedades de un apósito ideal.

Descritores: Enfermería; Estudio de caso; Dehiscencia de la herida.

INTRODUCTION

The nurse takes care of patients with wounds seeking to apply the most effective coverage through the most efficient healing process. However, their competence goes beyond curative care, because the nurse plans comprehensive care according to the specifics of each person, identifies their needs to promote health, prevent illness and recover it. Thus, caring for the person with a skin lesion requires a multiplicity of knowledge that interferes with the healing process, such as, for example, the underlying disease, nutritional status, allergies, skin hydration degree, associated diseases, among others.¹

In order for the patient to have a better result in his / her treatment, the nurse must pay attention to the appropriate choice of the coverage that will be used in the wound, emphasizing the following aspects: to be the most appropriate to the characteristics and the nature of the injury; promote patient comfort and well-being; Speed up the healing process; prevent and/or reduce wound complications; optimize the work done by the team; and result in a better quality of life for patients.²

The justification for this research is anchored in the recommendations of the Resolution of the Collegiate Board of Directors (RDC) nº 36. Such Resolution, published by the Ministry of Health in the year 2013, deals with patient safety and recommends, in one of its topics, safe surgery . Therefore, it equips the professionals to act in order to prevent complications such as infection and dehiscence of the operative wound, justifying, therefore, the importance of this study.³

The foam with silver is a cover whose material is polyurethane, absorbent, soft and adaptable to the patient's body. In addition, it features patented silver quantitative that makes it antimicrobial; Its material can be in the form of adhesive or non-adhesive and 3D structure. Used in wounds with a long healing process, wounds with risk of infection and exudative, such as: pressure injury, plantar ulcer in diabetic, leg ulcers, second degree burns, skin abrasions, postoperative wounds.⁴

The mode of action of the polyurethane foam with ionic silver is established by the contact of the material contained in the cover with the exudate. In addition, the 3D structure provides greater adaptation to the wound bed, even under pressure. The continuous antimicrobial effect is guaranteed during the entire time of use because of the distribution of silver ions, which occurs homogeneously. Silver is released into the wound bed for 7 days in the presence of exudate. It should also be noted that this coverage has a patented silver complex, in which a percentage is released according to the needs of the body of each human being, thus, does not present contraindications according to the manufacturer.⁴

In order to compare the coverings to be used in surgical wounds to compare them, silver sulfadiazine was chosen because it is part of the same group of polyurethane foam products with ionic silver, that is, both have the antimicrobial capacity. However, the foams have an absorptive property not found in silver sulfadiazine, since the presentation of this product marketed in Brazil is in ointment. Thus, in order to guarantee equivalence in the absorption, the sterile cotton pad was used as secondary cover, allowing the antimicrobial and absorptive equivalence in both products.

Sulfadiazine is widely used for treatment of intestinal, urinary and cutaneous infections, as well as malaria treatment. One percent silver sulfadiazine has been used as a reference for many years in the treatment of burn infections. In addition, associated with other substances collaborates reducing the time of infection in the leg ulcer and assists in the areas of skin graft abrasion. This coverage can also be used in infected lesions or with necrotic tissue, according to medical prescription.⁵

Silver sulfadiazine is bactericidal and bacteriostatic for a wide variety of bacteria and also for some fungus species. Bacterial replication is prevented because the silver ion undergoes a reaction together with the microbial DNA, altering it and preventing the growth of the microorganism. This coverage also promotes the breakdown of the cell

membrane and wall, and by the effect of osmotic pressure, the cell breaks completely.⁶

Considering the properties of both coatings, the following hypothesis was elaborated for the study: Polyurethane foam with ionic silver compared to silver sulfadiazine favors a reduction of wound edges, less exudation and a quick healing of the surgical wound.

The objective of this research is to describe the cicatricle process of surgical wounds infected with the use of polyurethane foam with ionic silver and silver sulfadiazine.

This study seeks to gather data that can support the systematization of nursing care and the orientation process for self-care, as well as the biopsychosocial well-being of people with infected lesions. As well as, it aims to contribute to nursing care based on scientific evidence, since it proposes to produce data that confirm or not, the rapid wound healing through polyurethane foam compared to silver sulfadiazine. In addition, this evidence may result in less time spent nursing care for people with this type of injury, since the accelerated healing process provides less care time; and a faster recovery of the patient, thus, a brief rescue of their activities of daily living.

METHOD

This is an observational, descriptive, prospective study of the data series type. In compliance with the ethical precepts, this research was registered in the Brazilian Platform of the Ministry of Health receiving protocol of approval n. 1,542,167, as recommended in Resolution No. 466/2012 of the National Health Council (CNS/MS), which regulates the development Research involving human beings.⁷

This research was carried out in an outpatient clinic of the university hospital located in the city of Rio de Janeiro, which treats patients with skin lesions and has the following epidemiological profile: pressure lesions, surgical wounds and vasculogenic ulcers with a higher incidence of venous type.

The total number of participants for this study was 4 clients. Thus, 02 people were treated with silver sulfadiazine and 02 subjects were treated with polyurethane foam with ionic silver. Patients who agreed to participate in the study signed a Free and Informed Consent Term (TCLE) and an Auto Image Term for the photographic record.

To be part of the study, the participants should present an infected surgical wound and be selected according to inclusion criteria of the study: I) age above 18 years; II) diagnosis of surgical wound with infection, indicating treatment by silver sulfadiazine and Polyurethane Foam with Ionic Silver; III) possibility of continuing treatment in their residences (in case of saturation of the product before the date of the return visit); IV) good cognitive and motor capacity for the learning and development of the dressing in the residence; and V) being treated at the outpatient clinic.

In order to assess the cognitive capacity of the patient / caregiver, the following methodology was applied: in the

first consultation the participants or their direct caregivers were advised to perform the dressing. Right after this step asked about understanding the method and questions about the procedure. Then the patient/caregiver was asked to explain to the researcher how to develop such a procedure. In the course of the consultations, before proceeding with the dressing, the patient or his caregiver was asked about the form of the dressing at home. Such conduct was characterized in the form of an assessment of the ability of the guidelines to be seized of the execution of the procedure.

Otherwise, the exclusion criteria were: I) use of any other type of product at the treatment site during the research development; II) previous report and / or development of sensitivity to silver or to any adjuvant components of the products tested during the research.

Participants were captured for the research according to the indications of use of the products and according to the evaluation of the wound by the professionals of the sector. Thus, according to the evaluation of the appearance of the wound and physiological characteristics of the users of the service, it was indicated the use of Foam (Group A) and use of Silver sulfadiazine (Group B).

Data collection was performed by the researcher, who performed the dressing procedure and the application of the data collection techniques, ie: the physical records of the participants and use of a clinical record called Pressure Ulcer Scale for Healing "PUSH" for the Direct evaluation of the surgical wound.

The Pressure Ulcer Scale for Healing (PUSH) instrument, used to evaluate the wound healing process and intervention results, was developed and validated in 1996 by the PUSH Task Force of the NATIONAL PRESSURE ULCER ADVISORY PANEL - NPUAP. This instrument encompasses three parameters⁸:

- I) Wound area related to greatest length (in the cephalophaudal direction) versus greatest width (in horizontal line from right to left), in square centimeters. After the multiplication of the two measurements to obtain the wound area, values varying from 0 to > 24cm and scores varying from 0 to 10, depending on the area obtained;
- II) Amount of exudate present in the wound, evaluated after the removal of the cover and before the application of any topical agent. It is classified as absent, small, moderate and large, which correspond to scores from 0 (absent) to 3 (large);
- III) Appearance of the wound bed, defined as the type of tissue prevalent in this region, being specified as: necrotic tissue (eschar), of a black, brown or brown color, which adheres firmly to the bed or the edges of the wound and may present more Hardened or softened compared to peripheral skin; Sphagnum, yellow or white colored tissue adhering to the wound bed and presenting as thick cords or crusts; Granulation tissue, pink or red in

color, shiny, moist and granular in appearance; Epithelial tissue appears as new pink or shiny tissue that develops from the edges or as “islands” on the surface of the lesion (superficial wounds) and closed or covered wound, the one completely covered with epithelium. These tissues correspond to the scores 0 (closed wound), 1 (epithelial tissue), 2 (granulation tissue), 3 (sphincter) and 4 (necrotic tissue).

The scores of the subscales when added generate the total score, whose possible variation is from 0 to 17. Larger scores indicate worse ulcer conditions and decreasing scores indicate improvement in the healing process of the lesion. Therefore, measuring only three variables, the PUSH instrument generates scores that, in their magnitude and direction, can describe the conditions and evolution of the wounds. In addition to the three parameters, the instrument contains operational definitions for each of them; A table in which the scores of each parameter are recorded and the total score according to the date; A graph to visualize the evolution of total scores; And an instruction sheet for the evaluator.⁸

In addition to the variables contained in PUSH, the mean healing time, the lesion size before and after the intervention, and the mean healing percentage were evaluated. In addition, some sociodemographic and lesion aspects, such as age, sex, education, ethnicity, profession, date of first care (A) in the outpatient clinic, surgery performed (CR), cognitive ability to develop the care of the wound and injury time.

Participants were approached by the researcher on the day of the first outpatient care, according to their schedule in the sector, and then the possibility of participating in the study was assessed by means of the inclusion and exclusion criteria of the research. Those who met the inclusion criteria and accepted the invitation to participate were included in this research.

After this stage, the researcher assisted the participants through the following flow: patient reception, anamnesis, dressing (wound cleaning with 0.9% saline solution), application of the Polyurethane Foam cover with Ionic silver or silver sulfadiazine, followed by occlusion of the wound with secondary covering (gauze, plaster, micropore, transparent film, bandage, etc.). At the end of this stage, the participants were oriented towards self-care at home. At each consultation, from the beginning of the treatment, the wounds were photographed to follow the evolution of the lesions, and the necessary records were made.

It should be noted that the researcher was able to perform such photographic records and that this procedure is protected by the signature of the authorization term for the use of the image, granted by the participants.

The dynamics of data collection occurred through evaluation of the type of tissue present in the wound bed, measurement of the lesion in relation to the width and length, observation of the quantitative exudate and analysis

of the wound photograph. All these data were evaluated during the dressing and then filled in the PUSH.

RESULTS

Of the total number of participants in the study (4), 3 were male and 1 female, with a mean age of 60 years, ranging from 31 to 84 years. All patients declared white. With regard to the level of education, participants range from complete primary education to full tertiary education. In relation to the profession, 3 patients were retired and one was active in the labor market. The time of displacement of the participants' residence to the outpatient clinic varied from 2 to 4 hours approximately.

Regarding the cognitive performance, after an evaluation in consultation, the participants presented a favorable and compatible cognitive capacity to perform wound care and dressing changes in their homes. It was found that they presented a caregiver in the family nucleus, who supported them and assisted in the accomplishment of the dressings. Most of the caregivers were women, and the family bond with the participants was from a spouse.

In the course of the research, no participant developed allergy to the covers used (polyurethane foam and silver sulfadiazine). However, 01 participant (P2) had allergic reaction to secondary adhesive coverage (clear film). It is noteworthy that after the episode, this participant was attended and the secondary adhesive coverage replaced by crepe bandage for occlusion of the dressing. It is also noted that three participants had associated diseases and that three participants contained an infected lesion on the underside of the thigh due to saphenectomy surgery.

The results regarding the health conditions of the participants can be better visualized in table 1, exposed below.

Table 1 - Health conditions of the patients studied. Rio de Janeiro, RJ, Brazil, 2016

PATIENTS	GROUP A			GROUP B	
	P1	P2	P3	P4	
ALLERGY	No	Yes	No	No	
BASIC DISEASES	Does not have	Hypertensive	Lymphatic insufficiency	Hypertensive	
LOCATION OF THE OPERATING WOUND	Internal thigh face MIE	Internal thigh face MIE	Internal thigh face MIE	Supra pubic	
SURGICAL PROCEDURE CARRIED OUT	RVM*, Safenectomy	RVM*, Safenectomy	RVM*, Safenectomy	Cesarean delivery	
DATE OF THE 1st EVALUATION	15/03/2016	15/03/2016	18/04/2016	05/05/2016	
PRODUCT	Foam	Foam	Sulfa	Sulfa	
EPITHELIZATION DATE / HIGH	12/04/2016	03/05/2016	03/05/2016	19/05/2016	
QUANTITATIVE OF CONSULTATIONS	5	9	4	3	

Source: The Authors

*RVM: revascularization of the myocardium

The studied population was divided into two groups: Group A (2 participants treated with polyurethane foam) and Group B (2 participants treated with silver sulfadiazine). It is reported that the 4 participants presented the complete process of wound healing, being discharged after the end of the treatment. Regarding the total number of consultations, it ranged from 3 to 9, with an average of 5 consultations per participant.

According to PUSH, in relation to the wound area (greater length versus greater width), group A participants presented a mean score ranging from 1 to 7 and a significant reduction in square centimeters ranging from 0.13 to 12.5 cm². Group B presented a score varying from 3 to 6.4 and a significant reduction in square centimeters varying from 0.10 to 3.3 cm².

In relation to the amount of exudate present in the wound, evaluated after the removal of the saturated dressing and before the new dressing (polyurethane foam with silver ion and Silver Sulfadiazine), the participants of group A and B presented at the beginning of the treatment Volumes of the fluid, ranging from large to moderate amount. Already during the healing process, when they presented epithelial tissue, this volume was small or absent in the lesion.

Regarding the appearance of the wound bed, that is, the type of tissue prevalent in the operative wound (necrotic tissue/eschar, sphagnum, granulation and epithelization), 2 participants had sphincter and 2 had granulation tissue. As the etiology of the lesions was operative wound, with dehiscence and infection, the predominance of the sphincter in the lesion was expected.¹ This type of tissue needs to be removed, since its presence prevents the adequate development of the cicatrization process.

It should be noted that during the consultations, after evaluation of the wound, a patient in group A (P2) required

conservative instrumental debridement (DIC) for mechanical removal of the sphincter adhered to the lesion bed, after which the coverage indicated in the procedure was applied the treatment (polyurethane foam). This procedure was necessary because the participant presented the wound completely covered by dry sphincter, thus not allowing the product to contact the lesion.

The graph below shows the evolution of the cicatrization of the lesions of the participants, evidencing that all of them evolved to healing, but those who used the polyurethane foam had a shorter healing time, especially considering that the wounds treated with such coverage were larger than those treated with silver sulfadiazine.

Graph 1 - Evolution of wound healing and wound characteristics of participants. Rio de Janeiro, RJ, Brazil, 2016

Patient 1 = P1; Patient 2 = P2; Patient 3 = P3 e Patient 4 = P4

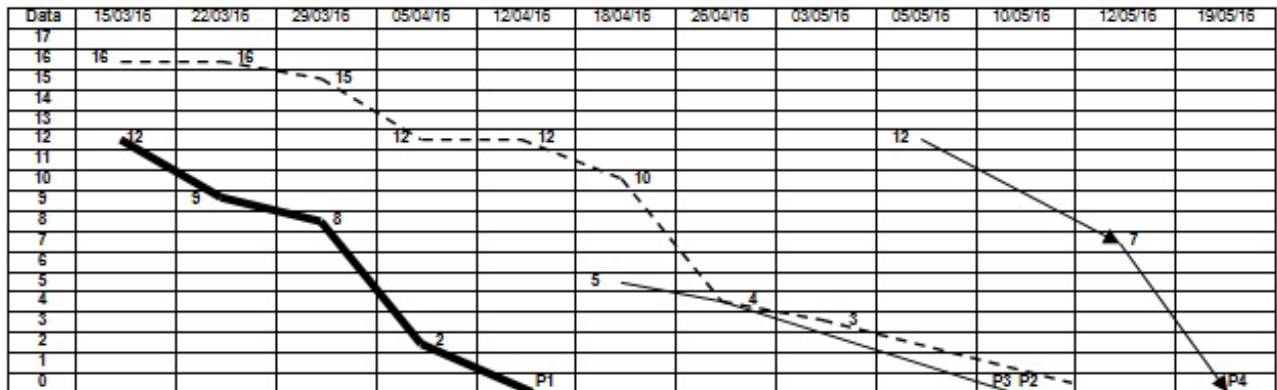


Figure 1 - Evolution of wound healing of P1 respectively 1st, 2nd, 3rd, 4th and 5th consultations



Figure 2 - Evolution of wound healing of P2 respectively 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th and 9th consultations



Figure 3 - Evolution of wound healing of P3 respectively 1st, 2nd and 3rd consultations



Figure 4 - Evolution of wound healing of P4 respectively 1st, 2nd and 3rd consultations



DISCUSSION

Corroborating the results of this research, studies have shown that the age group interferes with the risk of surgical site infection. Thus, at the extremes of age, infection rates have become higher. Such difference may be due to a greater presence of comorbidities in the case of the elderly; And in children due to the immaturity of the immune system.⁹ It

is emphasized that the greater the age, the greater the level of changes in the physiological systems resulting from nutritional, metabolic, vascular and immunological changes affecting the function and appearance of the skin.¹⁰

There are a growing number of elderly people in Brazil, which can generate a progressive increase in the number of elderly patients who present themselves to cardiovascular surgery services with a correlation of the increased incidence of coronary artery disease.¹¹

Thus, as evidenced in Table 1, it can be seen that two of the participants were elderly and one was only one year old to be characterized as an elderly person. In this sense, this study is in line with what has been occurring in the Brazilian population - inversion of the age pyramid - and that aging may have contributed to the infection of the surgical site.

Regarding the gender variable, research justifies the predominance of acute coronary disease (CAD) in the male population in relation to the female. Thus, this disorder affects twice as many men. In this perspective, men are more likely to perform myocardial revascularization with saphenous vein grafting, but they also suffer greater complications and higher rates of morbidity.¹²

The level of education cooperates to access and seize information related to prevention and care of wound treatment. In this study, it was observed that the level of schooling contributes to the satisfactory cognitive capacity for self-care and the accomplishment of the procedure.¹⁰

In relation to the incidence of diseases in the retired population, a study showed that the elderly who continue in their work activities report fewer chronic diseases than the retired elderly, confirming that, also among the elderly, a better health condition is positively associated with work.¹³ This data corroborates the results evidenced in this study, in which the retired participants who did not perform any labor activity were severely affected by CAD and required surgical intervention (myocardial revascularization with saphenous vein).

Myocardial revascularization surgery (RVM) allows the construction of an "alternative path" through the saphenous bridge, thus ensuring adequate blood circulation in the region. In order to perform such a procedure, a safenectomy is necessary, in this way the patient presents 2 operative wounds: one in the mediastinum relative to the cardiac surgery itself and another in the sap from the saphenectomy.¹²

Regarding myocardial revascularization, it is highlighted that it is classified as high complexity surgery, due to the etiology of the procedure (great estimated blood loss, location in a noble organ and great technical specificity of the team) and long duration of surgery (more than 4 Hours). In addition, such procedure involves a greater risk of infection, because it is performed through "open sky", that is, conventional surgeries, which present higher rates of complications when compared to video surgeries, which are minimally invasive.¹⁴

In addition, the aetiology of the lesion, location, nutritional aspects, the presence of comorbidities such as diabetes mellitus, obesity, hypertension (interferes in the process Scarring due to vascular complications leading to poor circulation), heart failure, vascular insufficiency, lymphatic insufficiency, immunosuppression, use of corticosteroids and the extremes of age.⁹ The prevalence and complexity of wounds may be aggravated And their resolution postponed because of these comorbidities.¹⁵

Lymphatic insufficiency, also called lymphedema, is characterized by accumulation of lymph in the interstitium. Usually at the beginning of the disease, it forms an edema because of this content, which then hardens due to fibrosis causing infection. With this, the appearance of this infection generates a bad prognosis for the wound healing.¹⁶

Regarding the wound healing process, it should be noted that in the absence of complications, the edges of the surgical wound are sutured, and the first intention closure occurs. However, when there are complications such as dehiscence and infection, the healing process does not occur physiologically (inflammatory phase, proliferative phase and maturation phase), resulting in the prolongation of the inflammatory phase. In this sense, healing delay occurs because there is interference in epithelialization, contraction and deposition of collagen for wound closure.¹⁷

As the covers used have antimicrobial properties, they are considered of great value for the treatment of the infected wounds. In addition, the literature recommends that there are four relevant characteristics that should be considered in the choice of antimicrobial products applied to infected wounds: toxicity, tissue permeability that should be low, resident microbiota, and retentivity.¹⁸

With respect to toxicity, permeability and retentivity, polyurethane foam exhibits better results compared to silver sulfadiazine. This is because the foam releases the silver in low and continuous concentrations in the period of up to 7 days and has no systemic absorption, only local. Sulfadiazine releases 10.00 mg of silver sulfadiazine in each 1 g of the cream, that is, a large quantity of silver soon after the application of the product; And has mild systemic absorption, which after prolonged treatment can lead to argirose (excess silver in the bloodstream).^{4,19}

Regarding the resident microbiota, the literature recommends that no silver product be used for a prolonged period, not to lead to metabolic imbalances, as well as resistance of microorganisms.²⁰

There are several options available to treat infections. However, in the last decade, the domain in terms of local treatment of wound infection belongs to silver dressings. This hegemony has been challenged in recent times by products with alternative active principles. Thus, the silver coating has been accompanying the evolution in the wound care process, allowing to continue as an extremely valid and effective option in the treatment of infected lesions complex.¹⁸

CONCLUSION

The study participants presented significant alterations in relation to the size of the lesion with rapid healing process, decrease in the amount of exudate and appearance of the granulation and epithelial tissues. However, it was found that all participants who used the polyurethane foam with ionic silver coating showed a rapid and effective improvement of the lesions when compared to silver sulfadiazine.

Thus, there was an excellent evolution of the lesions treated with polyurethane foam in relation to the following aspects: maintenance of humidity, absorption of excess exudate and maintenance of humidity, autolytic debridement, antimicrobial effect, gas exchange (oxygenation), thermal insulation, impermeability of the cover to the external environment and comfort.

In relation to silver sulfadiazine, the following characteristics were observed: maintenance of moisture, autolytic debridement and antimicrobial effect. In this way, it can be verified that the product presents limited action if compared to the desired one in an ideal dressing.

The healing process of the foam occurred in less time than the silver sulfadiazine, since its use suppressed the exudate and retracted the edges of the wound.

This research has found some difficulties in reaching the proposed initial quantitative of participants (8), since by the statistics of the sector an average of 80 patients per month are entered in this outpatient clinic, and of this amount approximately 10% are admitted monthly to treat surgical wounds Infected patients, that is, 08 patients.²¹ Because of the strike that was taking place in the institution where the study is being carried out, the number of surgery was significantly reduced, so the possibility of capturing possible participants with infected surgical wounds was limited.

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Received on: 07/11/2016

Reviews required: No

Approved on: 30/01/2017

Published on: 10/04/2018

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