

Perbandingan Efektivitas Penggunaan Bioceramic dan Kasa Lembab Naci Fisiologis terhadap Jumlah Koloni Kuman dalam Pembalutan Luka Pascadebridemen Patah Tulang Terbuka Kruris Derajat IIIA di Rumah Sakit Hasan Sadikin Bandung

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ABSTRAK

Pendahuluan. Perawatan luka setelah penanganan awal yang adekuat pada patah tulang terbuka memiliki peran yang sangat penting untuk mengontrol infeksi yang terjadi. Walaupun perawatan luka merupakan prosedur yang umum dilakukan pada patah tulang terbuka, tetapi masih ada kontroversi mengenai teknik perawatan luka yang optimal sehingga masih mempunyai resiko terjadinya angka infeksi. Terdapat berbagai usaha untuk mengurangi kejadian infeksi melalui perbaikan teknik perawatan luka atau bahan pembalutan luka yang digunakan. Salah satu metode untuk melakukan perawatan luka patah tulang terbuka adalah dengan *bioceramic*. Penelitian ini bertujuan untuk mengetahui perbandingan efektivitas penggunaan *bioceramic* dibandingkan dengan kasa lembab NaCl fisiologis terhadap jumlah koloni kuman dalam pembalutan luka pasca debridemen luka patah tulang panjang terbuka kruris derajat IIIA.

Bahan dan cara kerja. Desain penelitian ini adalah uji klinis dengan rancang acak sederhana yang membandingkan metode perawatan luka patah tulang terbuka kruris derajat IIIA menggunakan *bioceramic* dibandingkan dengan menggunakan kasa lembab NaCl fisiologis secara berurutan di Instalasi Rawat Darurat RS Dr. Hasan Sadikin sejak Desember 2010 hingga April 2011. Penelitian ini dibagi menjadi dua kelompok. Kelompok pertama mendapatkan perlakuan perawatan luka dengan *bioceramic* (n=13 pasien) dan kelompok kedua dilakukan perawatan luka dengan kasa lembab NaCl fisiologis (n=13 pasien). Bahan pemeriksaan diperoleh dari dasar luka, kemudian dilakukan penghitungan jumlah koloni kuman di Laboratorium Mikrobiologi FK Unpad.

Hasil. Hasil penelitian ini didapat 13 pasien yang menjalani perawatan luka dengan *bioceramic* dengan mean persentase penurunan jumlah koloni kuman setelah 2 hari perawatan adalah 84,3 persen dan setelah 7 hari perawatan adalah 83,4 persen. Pada kelompok yang menjalani perawatan luka dengan kasa lembab NaCl fisiologis, mean persentase penurunan jumlah koloni kuman setelah 2 hari perawatan adalah 78,3 persen dan setelah 7 hari perawatan adalah 75,6 persen. Hasil analisis statistik dengan menggunakan uji statistik parametrik *t-test* menunjukkan perbedaan bermakna pada perlakuan dua kelompok tersebut dengan nilai signifikansi $p < 0,01$

Simpulan. Penggunaan *bioceramic* pada perawatan luka pasca debridemen patah tulang panjang terbuka derajat IIIA memberikan hasil yang lebih baik terhadap penurunan jumlah koloni kuman dibandingkan dengan menggunakan kasa lembab NaCl fisiologis.

Kata kunci: bioceramic, kasa lembab NaCl fisiologis, patah tulang terbuka

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Comparison between the Effect of Bioceramic and Physiological Saline Moist Gauze on the Amount of Bacterial Colony in Post-Debridement Wound Dressings of Grade 3A Open Fractures of the Leg in Hasan Sadikin Hospital, Bandung

ABSTRACT

Introduction. In addition to an adequate initial treatment in open fractures, wound care also has a very important role to control infections that occur in the wound. There are various efforts to reduce the incidence of infection through the improvement of wound care techniques or materials used wound dressings. One method to treat an open fracture wounds is a bioceramic. The objective of the study is to determine the comparative effectiveness of using bioceramic compared with physiological saline moist gauze to the number of colonies of bacteria in the wound dressings, after wound debridement on lower leg open fractures grade IIIA.

Materials and methods. The design of this study is to design randomized clinical trials comparing simple method of treatment of lower leg open fracture wounds grade IIIA using bioceramic compared using physiological saline moist gauze in a row at the emergency ward of Dr. Hasan Sadikin Hospital from December 2010 until April 2011. The research was divided into two groups, the first group was given preferential treatment with bioceramic wound care (n = 13 patients) and a second group performed wound care with moist gauze physiological saline (n = 13 patients). Examination of materials obtained from the wound bed, then a head count of the number of bacteria colonies at the Laboratory of Microbiology Faculty of Medicine Universitas Padjadjaran.

Results. The results of treatment of wounds with bioceramic with mean percentage reduction in the number of bacteria colonies was 84.3 after 2 days of treatment and 83.4 after 7 days of treatment. While the group treated the wound with moist gauze physiological saline, the mean percentage reduction in the number of bacteria colonies were 78.3 and 75.6 after 2 and 7 days of treatment respectively. The results of statistical analysis using parametric statistical test t-test showed significant differences value with $p < 0.01$

Conclusions. The use of bioceramic on the treatment of post-debridement wound open long bone fractures grade IIIA will provide better results to the decline in the number of colonies of bacteria.

Key words: bioceramic, open fracture, physiological saline moist gauze

Introduction

Along with the advances of transportation technology, the number of traffic accidents was indirectly affected due to the higher speed and mobility of the traffic users. One of the most prevalent outcomes of a motor vehicle accident is grade 3A open fractures.¹

Infection prevention, fracture healing, and expedient return of normal and optimal function of the extremities is the main goal of open fracture management. Infection is correlated to delayed unions, non-unions, chronic osteomyelitis, amputations, and even death.²⁻³

Infection of an open fracture is affected by several factors, namely: the contaminating bacteria, the pathology of the tissue around the wound, and general immunity, as well as the proper management consisting of prophylactic antibiotics, wound dilution, debridement,

and wound care.⁴⁻⁵

Antibiotic alone is not enough to prevent infection, therefore wound dilution, debridement, and wound care after the debridement is a must. Sufficient wound dilution, adequate debridement, and good wound care can reduce the number of bacterial colony after the operation. Gustillo states that the solution to pollution is dilution.^{1,6}

Many efforts to reduce the number of infection may be performed, by wound dilution and effective wound dressing using physiological saline with addition of broad spectrum antibiotic solution.^{5,7}

There are several factors that may be used as an indicator of success of wound dilution and care, one is by doing a bacterial count. A bacterial count of 10^5 per gram of tissue indicates a probability of infection oc-

curing to the tissue, while with a bacterial count of less than 10^4 per gram of tissue infection will not occur.^{5,8}

Wound dressing after debridement of an open fracture may be performed using physiological saline moist gauze which offers the advantage of decreasing cell dehydration, reducing cell death, and increase tissue re-epithelization.⁹ Although in reality in the wards, patients that have underwent debridement of an open fracture followed by wound care using physiological saline moist gauze are still in risk for an infection.¹⁰

There have been efforts to reduce the number of infection through improvements of dressing methods, or the choice of dressing material. One of such is the use of bioceramics on the wound to protect the wound from risk of infection to achieve a faster wound healing.¹¹⁻¹²

Bioceramics may enhance wound healing by absorbing endotoxin that are present in the wound, keeping it at low levels and preventing infection. Other than that it has been discovered that bioceramics does not possess any antimicrobial activities.¹²

Another research mentioned that bioceramics is also used in the care of burn wounds, animal and human bite wounds, postoperative wound care of acute or chronic infected wounds.¹³

Bioceramics are packed in a highly absorbent package which has a high permeability that enables it to possess a high absorptive capacity to fluids in the form of purulent material, debris, and even blood. Therefore the base of the wound will always be in a clean and moist condition. This condition promotes the process of re-epithelization and granulation faster compared to conventional wound care.¹⁴

The purpose of this study was to determine the comparative effectiveness of using bioceramic compared with physiological saline moist gauze to the number of colonies of bacteria in the wound dressings, after wound debridement on lower leg open fractures grade IIIA.

Materials and methods

This study is a case control study to delineate the efficacy of bioceramics in the wound care of grade 3A open fractures of the tibia in reducing the number of bacterial colony. Twenty six patients have been assigned to different treatment using a simple random method and consecutive sampling of patients that meet the inclusion criteria being patients with grade 3A open fractures of the tibia, aged between 18 to 45 years old, and have not underwent debridement or antibiotic medication. One group was assigned to wound care using bioceramics and the other using physiological saline moist gauze. Samples were taken immediately after debridement,

after two days of wound care, and after seven days of wound care.

The samples are contained in sample tubes and taken to the Clinical Microbiology Laboratory. From the tubes, a homogenized sample is taken using a transfer loop sized 10μ . The samples are then inoculated in a blood agar medium in a petri dish and incubated at 37°C for 24 hours. After that we observed and performed bacterial colony counts.

To compare the decrease in bacterial colony count of each group, we performed a parametric t-test for coupled data to determine the p value using SPSS version 19.0. The significance is determined using a p value of less than 0.01.

Results

Within the period of 1 December 2010 to 30 April 2011 there were 26 patients with open fractures of the tibia that met the inclusion criteria. From this 26 patients we divided into two groups, one is the treatment group which received wound care using bioceramic dressing, and a control group which will receive wound care using physiological moist saline. The treatment group consisted of 12 males and one female, while the control group consisted of 10 males and 3 females. The range age of the subjects of this research is 18 to 45 years, with a mean of 27.8 years.

Shapiro-Wilk test confirmed that the data was normally distributed for all bacterial colony counts both for the treatment group and the control group. We performed a one-sample t-test for paired data analysis of the data obtained to describe the significance of difference in reduction of bacterial colony counts after debridement, after two days of wound care and after seven days of wound care between both groups.

Table 1 showed that there is a significant difference ($p < 0,000$) between the percentage of bacterial colony count reduction between the treatment group and the control group after the debridement and after two days of wound care.

Discussions

In this study we discovered a larger number of male patients compared to female patients with open fracture of the tibia (22 males and 4 females). This is in concordance to the study performed by Jamaludin, and an epidemiological study performed by Court-Brown and Caesar.^{15,16}

Female sex is correlated with better wound healing. This may be attributed to the higher estrogen hormone levels which may accelerate healing compared to the

higher testosterone hormone levels in male. However the effect is not statistically significant. Female patients entering menopause may experience reduction in wound healing speeds because to lowering of estrogen hormone levels.¹⁷

In this study, we did not perform a statistical analysis of the difference in reduction percentage of bacterial counts between the male and female patients, because of the disparity of the sample size which causes the data to lose its normal distribution.

The age span of the subjects is 18 – 45 years with a mean of 27.8 years. This result is similar to that found by Arifin (27.3 years).¹⁸

Age is also a factor that may influence wound healing. In previous studies it was found that age did not provide significant effect in wound healing time.¹⁹ However, further studies discovered that age does influence wound healing, where above the age of 60 years there will be a reduction in the speed of wound healing due to the lowering of hormone levels. This difference will become more marked when that patient is subject to other comorbidities at the time of the wounding, such as diabetes mellitus, blood vessel narrowing, and those on chronic immunosuppressive drugs.²⁰ In this research, the inclusion criteria is 18 to 45 years, and does not have comorbidities that may influence wound healing. Therefore, we did not perform a statistical analysis of the effect of age in the reduction of bacterial colony counts.

The effect of bioceramics in the wound care of grade 3A open fractures of the tibia may be seen in table 1. After two days of wound care there is a significant reduction in the number of bacterial colonies compared to immediately after debridement. Furthermore there is also a significant reduction in the number of bacterial colony counts in the treatment group compared to the control group at seven days of wound care. This may be attributed to the high absorptive and high permeability properties of the bioceramics that may enable absorption of purulent material, debris, and even blood, providing a clean and moist wound bed.¹⁴

The results of this study is also similar to that of Opoku and colleagues that used bioceramics as a dressing of diabetic foot ulcers by absorbing the endotoxin contained at the diabetic ulcer. The nature of bioceramic that binds exudates supports a wound bed free of endotoxins. This enables the wound to be spared from infection which may worsen the wound conditions.^{11,12}

By using bioceramics in the care of open wound care, there is an additional advantage of not having to

perform frequent wound dressing changes compared to conventional wound dressing using physiological saline. This spares the patients from discomfort that is associated with wound dressing change compared to wound dressing using physiological saline moist gauze that must be changed every time the dressing is dry. Whereas when using physiological saline moist gauze, the epithelization that has been achieved may be disrupted every time the dry dressing is changed. This does not occur when using bioceramic dressing.¹²

Another disadvantage that was avoided is a period of drying that is associated with dressing using physiological saline moist gauze. Where on dressing change the dry gauze does not selectively lift necrotic tissue, but also the healthy tissue as well.²¹

The limitations of this study is that the number of bacterial colony prior to debridement is not evaluated, and that the sample was taken only from one part of the wound, and may only re-present the percentage of bacterial colony on one part of the wound only. This method was selected to prevent the patient from discomfort that may be associated from obtaining sample from other parts of the wound.

Conclusions

The study concludes that the use of bioceramics in the post debridement wound care of grade 3A open fractures of the tibia is associated with a significantly larger percentage of bacterial colony count reduction compared to using physiological saline moist gauze.

Table 1. Statistical comparison between the percentage of bacterial count reduction of the bioceramic treatment group and the physiological saline moist gauze control group

Observation	Mean Bioceramic (Percentage)	Mean Moist Gauze NaCl (Percentage)	<i>p</i>
2 nd day of wound care	84.3	78.5	0.000
Up to 7 th day of wound care	83.4	75.8	0.000

P value < 0.01 indicates a significant difference in

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