

Investigations into the Pathogenic Bacterial Infection of Wounds and Its Analysis

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Abstract. OBJECTIVE. This paper investigates the pathogenic bacterial infection status of wound, and evaluates the effects and effectual time of silver dressings on different pathogens, in order to provide scientific guidance for the clinical treatment of wounds. METHODS. Researchers chose 165 chronic wound patients who were in our hospital from August 2015 to September 2016. Retrospective survey was made on the basic information of all these patients. After debridement, silver dressings were applied to their wounds. The results of intervention were analyzed retrospectively. RESULTS. Before the intervention, the positive rate of pathogenic bacteria was 78.18% in 165 samples, and the positive rate of drug resistance bacteria was 71.52%. 9 kinds of pathogenic bacteria were found, among which staphylococcus aureus and pseudomonas aeruginosa accounted for the largest proportion. After 1 week, 2 weeks and 4 weeks of intervention, pathogen positive rates of all patients greatly declined, and the differences were statistically significant ($P < 0.05$). Escherichia coli and staphylococcus aureus decreased most significantly. After statistical analyses, the differences of patients' wound areas and pain scores before and after the intervention were significantly different ($P < 0.05$). CONCLUSIONS. Through the investigation and analysis of common pathogenic bacteria in wounds, it has been found that high positive rate of pathogens can impact the healing of wounds. Meanwhile, silver dressing has different antibacterial effects on different bacteria. So it should be applied to wounds continuously. When applying silver dressings, medical persons should take comprehensive factors, like the types of patients' wounds and bacterial species into consideration. The scientific and rational usage of silver dressing can reduce infection rates and improve patients' health qualities.

Introduction

Wound infection is a major factor that affects the healing of wounds. With the increasing clinical diseases and the growing popularity of operative treatment, the number of wound infection cases is growing year by year. The clinical symptoms of wound infection are dormant, and multiple bacterial infections are commonly seen. Drug resistance is commonly seen in wound infection, while the bacterial biofilms are easy to form. Thus, antibiotics are difficult to obtain an ideal therapeutic effect [1-2]. Therefore, it is key to accurately identifying and classifying the types of pathogens, and to conduct specific treatments for different patients. Researchers chose 165 chronic wound patients who were in our hospital from August 2015 to September 2016 as research objects, investigated pathogenic bacterial infection of their wounds, and then evaluated the effects and effectual time of silver dressings on various pathogenic bacteria. Specific contents go as follows.

Research Materials and Methods

Research materials. Researchers chose 165 chronic wound patients who were in our hospital from August 2015 to September 2016 as research objects. 86 patients were male while 79 patients were female. The oldest patient was 77 years old; the youngest was 19 years old. The average age was (40.23 + 1.59). Their wounds were lasting for 27 to 108 days, and the average duration was (60.65 +

15.59) days. 47 patients suffered from venous ulcers, 65 from pressure ulcers, and 53 from foot ulcers.

In this research, all patients' wounds had following features. They had not healed for more than 28 days; their clinical features included bacterial colonization or infection, persistent pain, redness and fever, large quantity of ooze liquid, odor and necrotic tissues. [3]

The following patients were not included in the research. (1) Their intervention periods were less than 1 week; then they left the hospital, and doctors could not contact them anymore. (2) Vital signs of patients were not stable, which could impose unnecessary effects on bacterial culture observation. [4]

Research methods. Before the investigation, risk assessment was conducted by professional personnel in our hospital. They evaluated risk factors in wound healing. Based on the results of assessment, preliminary treatment plans are made. Researchers introduced the purpose and methods of investigation to patients and their family members at their first visit to hospital, and told them the main benefits and potential risks of the pathogen investigation. After that explanation, the research was conducted under patients' and their families' agreement. Researchers adopted standard methods to get samples for bacterial culture. Patients' wounds were washed by saline for 3 times. Then carrion and necrotic tissues on the surface of wounds were removed. Basal exudates were smeared smoothly on the wounds from one end to the other by aseptic cotton buds. After that, samples were put in containers and immediately sent to the laboratory for isolating, culturing and identifying bacteria and performing drug sensitivity tests.

Trained nurses checked and treated patients' wounds regularly, and made preliminary assessments according to patients' primary diseases, nutritional intake, nutritional structures and the control of complications. Factors which may affect the healing of wounds were analyzed according to the results of entire body assessments, and then specific intervention plans were made according to these analyses. Local intervention included evaluations and measurements of wound areas after applying dressings, together with investigations and evaluations on tissue types, the amount of exudates and the relief of pain. Based on these investigations and evaluations, necrotic tissues and wounds with debridement indications were washed by saline, or cleaned by debridement instruments. Conservative sharp devices were also used to gradually remove necrotic tissues. Silver dressings were applied to wounds to control infection and leachate. The dressings were applied once every two days for 4 weeks or until the time of wound healing.

Observational index. Researchers analyzed pathogenic bacteria and their distribution of all patients, and recorded data on bacterial distribution, wound areas, pain scores and positive rates of pathogen after 1 week, 2 weeks and 4 weeks of intervention. Then, contrastive analysis was made between data before and after intervention.

Statistical analysis. The statistical software SPSS18.0 was used to statistically analyze all data involved in this study. (+ s) and (%) were adopted as variables index and count parameter respectively. Independent sample T test and x² test were used to analyze data of different groups. The differences show statistically significance if their statistical values of $P < 0.05$.

Results

Species and distribution of common wound pathogen. Pathogenic bacteria were found in 129 patients, the positive rate was 78.18%. Drug resistance bacteria were detected in 118 patients, the positive rate was 71.52%.

9 species of pathogenic bacteria were detected. Staphylococcus aureus was found in 57 patients, accounting for 44.19%; pseudomonas aeruginosa was detected in 27 patients, accounting for 20.93%; escherichia coli was found in 17 patients, accounting for 13.18%; coagulase negative staphylococcal was detected in 11 patients, accounting for 8.53%; coinfection of staphylococcus aureus and pseudomonas aeruginosa was found in 8 patients, accounting for 6.20%; proteus was found in 5 patients, accounting for 3.88%; enterobacter cloacae was detected in 2 patients, accounting for 1.55%; klebsiella pneumoniae was found in 1 patient, accounting for 0.78%; mycobacterium was found in 1 patient, accounting for 0.78%.

Comparative analysis on wound areas and patients' pain scores before intervention, after 1 week, 2 weeks and 4 weeks of intervention. According to statistical analysis results, the differences on patients' wound areas and pain scores before and after the intervention were significantly different ($P < 0.05$). Specific data can be found in table 1.

Table 1 Comparative analysis on wound areas and patients' pain scores before intervention, after 1 week, 2 weeks and 4 weeks of intervention

Time period	Number of cases	$(\bar{x} \pm s)$	
		Wound areas (cm)	Pain scores
Before intervention	165	15.38±5.96	7.78±1.85
1 week after intervention	165	12.68±6.79	5.68±1.74
2 weeks after intervention	165	11.06±3.26	2.38±0.78
4 weeks after intervention	165	9.54±2.26	1.15±0.37

Comparative analysis on antibacterial effects for different pathogenic bacteria before intervention, after 1 week, 2 weeks and 4 weeks of intervention. After 1 week, 2 weeks and 4 weeks of intervention, pathogen positive rates of all patients declined greatly, and the differences were statistically significant ($P < 0.05$). *Escherichia coli* and *staphylococcus aureus* decreased most significantly. Specific data can be found in table 2.

Table 2 Comparative analysis on antibacterial effects for different pathogenic bacteria before intervention, after 1 week, 2 weeks and 4 weeks of intervention

Pathogen types	before inter- -vention	Negative after 1 week of intervention	2 weeks after intervention	4 weeks after intervention	The value of P
staphylococcus aureus	57 (44.19)	12 (9.30)	32 (24.81)	38 (29.46)	0.000
pseudomonas aeruginosa	27 (20.93)	1 (0.78)	5 (3.88)	12 (9.30)	0.000
escherichia coli	17 (13.18)	2 (1.55)	8 (6.20)	10 (7.75)	0.000
others	28 (21.70)	6 (4.65)	15 (11.63)	21 (16.28)	0.000

Discussions

Pathogen is a general term which refers to all pathogenic bacteria that can cause wound infection. Many studies show that *pseudomonas aeruginosa* and *staphylococcus aureus* are most common wound pathogens, and the main sources of acquired infection [5-6]. They are commonly found in wound infection, but they are not easy to be cleared. Moreover, the two kinds of bacteria can infect wounds together, and expand the wound area. Bacterial biofilms are easily formed, while antibiotics cannot take good effects on biofilms. Silver oxide and silver ion in silver dressings can react with biofilms, and cause albuminous degeneration. RNA and DNA of bacteria lose their abilities of transcribing and replicating genetic information. Thus, the growth and reproduction of bacteria are controlled. In addition, silver dressings are currently widely recognized as antimicrobial dressings. They have been widely used in clinical treatment of acute and chronic wound infections, especially in the treatment of bacterial biofilms. [7] However, in clinical practice, it is still necessary for us to

adjust use time according to the types of chronic wounds and the growth of bacteria, in order to give full play to the therapeutic values of silver dressing.

The research shows following facts. Before the intervention, the positive rate of pathogenic bacteria was 78.18% from 165 samples, and the positive rate of drug resistance bacteria was 71.52%. *Staphylococcus aureus* and *pseudomonas aeruginosa* were most common pathogenic bacteria. After 1 week, 2 weeks and 4 weeks of intervention, pathogen positive rates of all patients greatly declined, and the differences were statistically significant. *Escherichia coli* and *staphylococcus aureus* decreased most significantly. What's more, after intervention, patients' wound areas and pain scores reduced significantly. The research results are similar to related literature and medical reports. [8] This study represents that, the higher positive rate of pathogenic bacteria, the longer time will be needed to heal wounds, and the more difficulties will be faced during this process. Meanwhile, silver dressings have different antibacterial effects on different patients. When applying silver dressings, clinical medical persons need to take the specific situations of patients into consideration, and make specific treatment plans, in order to shorten the time of wound healing, and improve patients' health qualities

In summary, through the investigation of common pathogenic bacteria of wounds, we find that high positive rate of pathogen can influence the healing of wounds, and silver dressings have different antibacterial effects on different bacteria. So they should be applied to patients continuously. When applying silver dressings, clinical medical persons ought to take comprehensive factors, like the types of patients' wounds and bacterial species into consideration. The scientific and rational usage of silver dressing can reduce infection rates and improve patients' health qualities.

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