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Comparative Study on the Costs of Treating Diabetic Foot, Necrotizing Fasciitis, and Stage IV Pressure Ulcers

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Abstract: Objective: To compare the total treatment costs for patients with diabetic foot with osteomyelitis, necrotizing fasciitis, and stage IV pressure ulcers in Dalian city, to explore the economic burden of different types of chronic wounds. Methods: A retrospective analysis design was used, collecting data from 18 patients (6 of each wound type) from the electronic medical record system of a large hospital in Dalian. One-way ANOVA and Tukey's HSD post-hoc tests were applied to compare the treatment costs of different wound types. Results: The treatment costs for the necrotizing fasciitis group were significantly higher than those for the stage IV pressure ulcer group, while the costs for the diabetic foot group did not show significant differences from the other two groups. This finding highlights the impact of chronic wound types on treatment costs and the importance of early intervention. Conclusion: The results provide data support for the optimized allocation of medical resources, especially in a context of limited resources. They emphasize the necessity of early identification and management of chronic wounds and provide a basis for establishing cost-effective treatment strategies.

Keywords: Chronic Wound; Socio-Economic Factors; Treatment Costs

Introduction

In the fields of medicine and public health, chronic wounds, including diabetic foot, necrotizing fasciitis, and stage IV pressure ulcers, have always been a problem of significant clinical and socio-economic importance1. These complex clinical conditions require highly personalized treatment strategies and often long-term care, which undoubtedly increase overall medical costs. With the exacerbation of global population aging, these issues are expected to grow, making the exploration of chronic wound treatment costs an urgent issue to be addressed.

In China, with the rapid development of the economy and changes in population structure, the incidence of chronic diseases is on the rise, and the increasing costs of chronic wound treatment are posing a significant burden on families and socio-economic development2. The treatment costs of diabetic foot, necrotizing fasciitis, and stage IV pressure ulcers, as three major types of chronic wounds, and their impact on patients' financial status have not been fully studied. Especially in specific cities like Dalian, the specifics and comparisons of these costs are not clear.

In recent years, the healthcare services and medical insurance system in Dalian have undergone significant changes, which may affect the treatment costs of patients with chronic wounds. Therefore, studying the treatment costs of patients with chronic wounds in Dalian is not only important for local medical decision-making and resource allocation but may also provide valuable experience and reference for other similar cities3.

The purpose of this study is to compare the total costs incurred during the treatment of patients with diabetic foot, necrotizing fasciitis, and stage IV pressure ulcers in Dalian. Through this comparison, we aim to explore the economic burden of different types of chronic wounds and analyze how these burdens reflect the specific medical resource allocation and disease management strategies of Dalian city. Additionally, this study will discuss the impact of these costs on the financial status of patients' families and the potential significance of these findings for optimizing medical resource allocation and improving disease prevention and early intervention4.

Association Between Chronic Wound Treatment Costs and Socio-economic Factors

The treatment costs of chronic wounds and their association with socio-economic factors is a multi-dimensional and complex issue. In China, this issue is particularly concerning due to significant disparities in economic development levels, medical resource distribution, and

social security systems across different regions5. These disparities not only affect patients' access to medical services but also determine the extent to which they bear medical expenses.

Firstly, the high costs of chronic wound treatment pose a particular challenge for low-income groups. These patients may not be able to afford optimal treatment plans, such as the use of modern wound care technologies and advanced biomaterials, potentially leading to poor treatment outcomes and chronicity of the disease6. Moreover, due to financial pressure, these patients might delay seeking medical care, leading to the exacerbation of their condition, increasing the ultimate treatment costs and socio-economic burden7.

Materials and Methods

This study employed a retrospective analysis design to compare the total treatment costs of three different types of chronic wounds in Dalian city—diabetic foot with osteomyelitis, necrotizing fasciitis, and stage IV pressure ulcers.

Study Subjects:

The study sample included patients treated from January to December 2022 at a large hospital in Dalian city. Inclusion criteria included: 1) Patients diagnosed with diabetic foot with osteomyelitis, necrotizing fasciitis, or stage IV pressure ulcers; 2) Aged between 45 and 85 years; 3) Treated surgically and recovered. Exclusion criteria included: 1) Patients with necrotizing fasciitis and stage IV pressure ulcers who also had diabetes; 2) Patients needing parenteral nutrition, or whose vital signs were poor requiring rescue and ICU treatment. In the end, 6 patients were included in each group, equally divided between male and female.

Data Collection:

Data collection included patients' basic information (age, sex, condition, etc.) and treatment-related costs. Treatment costs included hospitalization fees, surgical fees, medication fees, material fees, and other related costs. All data were obtained from the hospital's electronic medical record system.

Statistical Analysis:

One-way ANOVA was used to compare the treatment costs of the three groups of patients. Subsequently, post-hoc multiple comparison tests were conducted to determine the specific cost differences between different types of chronic wounds. Tukey's HSD test was used for post-hoc comparisons. All statistical analyses were completed using GraphPad Prism statistical software. The significance level in the results was set at $p < 0.05$.

Results

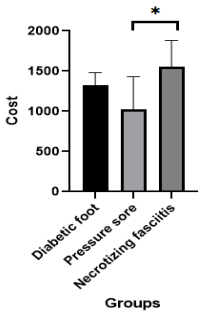
The statistical analysis of this study was based on the treatment cost data of three different groups of chronic wound patients in Dalian city: diabetic foot with osteomyelitis, necrotizing fasciitis, and stage IV pressure ulcers. One-way ANOVA was performed on 18 samples (6 samples per group) to assess whether there were statistically significant differences in the average treatment costs between the three groups, as shown in Table 1.

Necrotizing fasciitis				Diabetic foot				Stage iv pressure sore			
gender	Days	Cost	Cost/Day	gender	Days	Cost	Cost/Day	gender	Days	Cost	Cost/Day
F	20	31714.52	1585.73	F	21	24182.64	1151.55	F	15	15955.67	1063.71
M	18	22204.62	1233.59	M	15	22513.44	1500.90	M	13	23193.08	1784.08
M	5	9352.27	1870.45	M	15	17324.07	1154.94	F	9	8789.03	976.56
F	23	26782.77	1164.47	F	12	17620.43	1468.37	M	48	31058.46	647.05
F	7	10780.32	1540.05	M	15	19512.04	1300.80	F	16	15338.77	958.67
M	7	13708.02	1958.29	F	14	19504.05	1393.15	M	37	27281.86	737.35
Average cost/day	1558.76			Average cost/day	1328.28			Average cost/day	1027.90		

Table 1: The table shows three groups of patients, with the data for each patient group from left to right being sex, hospitalization days, treatment costs, and average daily treatment costs. The last column for each group shows the average daily treatment costs for that group.

Descriptive statistics showed that the average treatment cost for the diabetic foot group was 19,090.42 yuan, with a standard deviation of 9,177.12 yuan. The average treatment cost for the pressure ulcer group was 20,109.44 yuan, with a standard deviation of 2,722.02 yuan. The necrotizing fasciitis group had the highest average treatment cost of 20,269.48 yuan, with a standard deviation of 8,352.77 yuan.

The ANOVA results showed (as seen in Figure 1) that the F-value for the variance analysis between the treatment groups was 4.414, with a p-value of 0.0311, indicating that there were statistically significant differences in average treatment costs between at least two groups. The R-squared value was 0.3705, meaning that the type of treatment could explain about 37.05% of the total variance.



Further post-hoc multiple comparisons using Tukey's HSD test yielded the following results: the average difference between the diabetic foot and pressure sore groups was 300.4 yuan, with a 95% confidence interval (CI) of -165.0 to 765.8 yuan, and an adjusted p-value of 0.2462, indicating no significant statistical difference between the two groups. The average difference Figure 1: The X-axis represents the three groups, and the Y-axis represents the treatment costs. The bars marked with an asterisk indicate statistically significant differences between them.

between the diabetic foot and necrotizing fasciitis groups was -230.5 yuan, with a 95% CI of -695.9 to 234.9 yuan, and an adjusted p-value of 0.4240, also indicating no significant difference between the two groups. The average difference between the pressure sore and necrotizing fasciitis groups was -530.9 yuan, with a 95% CI of -996.3 to -65.45 yuan, and an adjusted p-value of 0.0247, indicating a significant difference between the two groups.

In conclusion, these results suggest that, in Dalian city, the treatment costs for patients with necrotizing fasciitis are on average higher compared to those with stage IV pressure ulcers. However, the treatment costs for patients with diabetic foot did not show significant differences from the other two groups.

Discussion

The purpose of this study was to compare the treatment costs for patients with diabetic foot with osteomyelitis, necrotizing fasciitis, and stage IV pressure ulcers in Dalian. The results revealed differences in the treatment costs of these three types of chronic wounds, especially between necrotizing fasciitis and stage IV pressure ulcer patients8.

When interpreting these differences, we must consider a variety of possible influencing factors. Necrotizing fasciitis, due to its rapid progression and high mortality rate, typically requires urgent and invasive medical interventions, including but not limited to extensive surgical debridement and long-term antibiotic treatment. This may explain why the average treatment cost for this group was the highest. In contrast, although stage IV pressure ulcers also require long-term management and costly care, their treatment costs are lower compared to necrotizing fasciitis. This may be partly due to differences in treatment methods and strategies, as well as the disease course and recovery speed of different wound types9.

The treatment costs for patients with diabetic foot did not show significant differences from the other two groups. This may be related to the standardized degree of treatment. Patients with diabetic foot typically receive standardized multidisciplinary treatment, including blood sugar control, local wound management, and appropriate foot protection10. Nevertheless, this result may hide underlying complexities, as the treatment costs for diabetic foot may be influenced by a variety of factors, including the control of diabetes, the occurrence of complications, and the possibility of readmission.

Furthermore, our study results emphasize the importance of early and proactive intervention for patients with chronic wounds. In clinical practice, adherence to evidence-supported treatment methods can effectively control treatment costs. For instance, for patients with pressure ulcers, regular position changes and the use of pressure-distributing mattresses might prevent the worsening of pressure ulcers, reducing the number of patients requiring expensive treatment.

When analyzing the study results, we must also acknowledge the limitations of the study. The small sample size may affect the generalizability of the statistical results, and future research should include a broader patient population to validate these findings. Additionally, this study only focused on direct medical costs and did not consider indirect costs, such as loss of work capacity and family care expenses, which

may significantly impact the overall economic burden of chronic wounds.

Another limitation of the study is that it did not consider differences in the severity of the condition, which may affect treatment costs. Future research should incorporate the severity of the condition as a covariate to more comprehensively assess treatment costs11.

Lastly, our findings have potential implications for medical decision-making and policy formulation. A deep understanding of the treatment costs of chronic wounds can help health policy makers optimize resource allocation, especially in situations with limited budgets. Moreover, this information is crucial for developing cost-effective treatment plans that help improve patients' treatment outcomes and quality of life.

Conclusion

This study compared the treatment costs for patients with diabetic foot with osteomyelitis, necrotizing fasciitis, and stage IV pressure ulcers. The results showed that although there are differences in the treatment strategies and costs of these three chronic wound types, the average treatment costs for patients with necrotizing fasciitis were significantly higher than those for stage IV pressure ulcer patients. Meanwhile, the treatment costs for diabetic foot patients did not show significant differences from the other two groups.

Future research should focus on a broader patient group, consider the severity of the condition, and include indirect costs to fully understand the economic burden of chronic wounds.

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